

**Eating Pathology: Links to Childhood Feeding and Interaction with  
Mealtime Environment**

By

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degree of DOCTOR OF CLINICAL PSYCHOLOGY

Volume One: Research Component

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## **DEDICATION**

This work is dedicated to all the people that have contributed to my academic, clinical and personal development over the last three years. To the supervisors who guided me in the right direction, the colleagues who supported me along the way and the clients who make it all worth it.

## **ACKNOWLEDGEMENTS**

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My career so far has entirely been made possible by my parents and their continuous support; both financial and emotional, for which I will be eternally grateful. I would not have achieved what I have so far without their support through voluntary positions and ongoing financial top-ups.

Finally, thanks go to my now fiancé, Matthew, for his ongoing support, concern, encouragement and of course, the contribution of his expert psychological opinion.

## OVERVIEW

This thesis, submitted in partial fulfilment of a Clinical Psychology Doctorate, consists of two volumes. The research component of the thesis is presented in Volume One and includes a literature review, an empirical paper and an executive summary. The literature review considers the possible relationship between early childhood feeding practices and the development of later non-organic feeding and eating disorders. The empirical paper presents a laboratory study of the interaction between eating psychopathology and distraction during eating. An executive summary of both these pieces of work is also presented.

The clinical component of the degree is presented in Volume Two and consists of five clinical practice reports. The first two reports were completed during an older adults placement. The models formulation report presents the assessment of a man with moderate depression, triggered by loss. His difficulties are formulated within a cognitive-behavioural model, adapted for older adults, as well as a psychodynamic model using Malan's triangles.

The second report constitutes a service evaluation, where the role and integration of the psychology department was investigated within the older adults community mental health team. The main aim was to review whether Department of Health and British Psychological Society national guidelines were being followed with regards to the integration of psychological ways of

working. Information regarding the team's perception of the role of psychology and their use of psychological approaches was gathered through semi-structured interviews and a Likert questionnaire with seven multi-disciplinary members of staff. Conclusions are drawn with reference to models of organisational change. Recommendations are made in terms of increasing collaboration and integration within the team and incorporating the national guidelines.

The third report presents a case study of a complex child presenting with social, behavioural and attachment difficulties, completed on placement in a children's community mental health team. The fourth report describes an AB single-case experimental design of a behavioural intervention for challenging behaviour with a woman with a moderate learning disability and attachment difficulties. A summary of the fifth report is then presented, which summarises a case study oral presentation describing the assessment, formulation and intervention of a young woman with a learning disability, challenging behaviour, mental health difficulties and neurological impairment.

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## **LITERATURE REVIEW**

### **The role of feeding practices in the development of non-organic feeding disorder and later eating disorder**

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## **LITERATURE REVIEW**

### **The role of feeding practices in the development of non-organic feeding disorder and later eating disorder**

#### **ABSTRACT**

The review investigated possible relationships between early childhood feeding practices and the development of later eating disorder by examining two longitudinal relationships; the relationship between maternal feeding practices and the development of child feeding problems and the relationship between feeding problems and the development of later eating disorders. 22 articles were included in the review. Articles pertaining to feeding problems within developmental conditions or with a focus on obesity were not included in the review; articles included were limited to feeding problems related to psychological, non-organic difficulties.

Findings suggest that maternal feeding practices significantly contribute to the incidence of child feeding problems but evidence for links with later eating disorders is inconclusive. Modelling appears to have positive outcomes, whilst contingency-based strategies, pressure-to-eat and restriction are associated with higher levels of feeding problems. Feeding problems are explored in terms of the disinhibited-restrained eating continuum and a model is proposed to explain the relationship between feeding practices and feeding difficulties.

It is concluded that maternal feeding practices are associated with a child's eating style, which is often indicated by specific feeding difficulties and behaviours and potentially continues into later life. The direction of this association is unknown, however, and it is concluded that the feeding episode is a bidirectional, interactive process. Feeding is explored as an insight to the wider context, including the mother-child relationship, which needs to be considered when assessing the difficulties. Further research is needed into the longitudinal relationships between feeding practices and eating disorder, before more robust conclusions can be drawn.



## INTRODUCTION

Research indicates that childhood feeding problems can be associated with later difficulties requiring professional intervention, including behavioural problems (Galler et al., 1983), cognitive delays (Drotar & Sturm, 1988) and anxiety disorders (Timimi et al., 1997). It is also thought that children's potentially lifelong eating behaviours develop during their first years (Aldridge et al., 2010), when they are reliant on parents' feeding strategies. As a result, there is an increasing focus on early feeding experiences as a source of both preventative and reactive clinical interventions (Powell et al., 2011).

Feeding problems and eating disorders are often equated or at least, a developmental continuum between the two is assumed (Southall & Martin, 2010). However, eating disorders have somewhat different presentations to feeding disorders (Bryant-Waugh et al., 2010) and although there is an evidence base for links between feeding practices and feeding disorders, research into links between feeding and eating disorders is less comprehensive. It therefore remains unclear what the consequences of early feeding problems may be and the potential role of feeding practices in this.

## **Prevalence of feeding and eating disorders**

Historically, it has been thought that feeding disorders affect 1-2% of children but this figure has increased to as high as 25-45% in recent years (Bryant-Waugh et al., 2010; Lyons-Ruth et al., 2006; Coulthard & Harris, 2003; Ramsay et al., 2002; Coolbear & Benoit, 1999), if feeding problems below the diagnostic threshold are included. As many as 50% of under-5-year-olds (Beautrais et al., 1982; Chatoor, 2002; Coulthard & Harris, 2003; Southall & Martin, 2010) and up to 35% of 8-11-year-olds (Matton et al., 2013) now present with an eating problem, ranging from transient to long-term problems requiring professional intervention (Kedesdy & Budd, 1998).

Anorexia nervosa (AN) and bulimia nervosa (BN) are two specified adult eating disorders according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV (APA, 2000); DSM-V (APA, 2013)), with prevalence rates of up to 6% for AN and 2% for BN in Western countries (Makino & Tsuboi, 2004). However, the prevalence of eating disorders where symptoms do not meet criteria for either AN or BN tends to be higher; a 5-7% prevalence and more than 50% of clinical eating disorder cases (Smink et al., 2012).

## **Classification of feeding disorders**

There is an historic lack of a nationally accepted classification system for feeding disorders and a dearth of evidence-based guidance to distinguish significant feeding problems from short-lived difficulties (Bryant-Waugh et al., 2010). The DSM introduced the diagnosis of “feeding disorder of infancy and early childhood” in 2004 and in the latest edition, “avoidant/restrictive food intake disorder”. However, the criteria are criticised for being too wide and not differentiating between subtypes (Lucarelli et al., 2013). Further, significant weight problems are implicated whereas limited diets do not necessarily impact upon weight, despite effects on physical and psychosocial development (Bryant-Waugh et al., 2010).

A variety of terms are used to describe feeding behaviours, both clinically and in research, which leads to an unclear picture and potentially hinders development of evidence-based interventions. Researchers and clinicians often rely on clinical judgement to assess feeding problems, often defining their own criteria based on experience (e.g. Chatoor, 2002). Unfortunately, these often vary greatly and result in an assortment of incompatible approaches (Bryant-Waugh et al., 2010). A further criticism is that the emphasis is often placed on the problem being solely the child's, which does not capture important contexts in which the child lives (Davies et al., 2006) or the interactional relationship with the caregivers.

## **Aetiology of feeding disorders and eating disorders**

There are already known risk factors in the development of feeding problems, which can broadly be categorised into environment, internal and social. Only 16-30% of feeding disorders have been identified as relating to organic problems (Benoit, 2000) and as a result, research into the psychological factors in feeding disorders has grown. For example, there is evidence for the influence of individual personality factors or traits on feeding behaviour, such as trait anxiety and poor self-concept (e.g. Davids & Lawton, 1961). Further, individual factors including difficult child temperament may impede the way a child and caregiver interact at mealtimes (Haycraft et al., 2011; Aldridge et al., 2010; Hughes et al., 2008; Farrow & Blissett, 2006), which can then manifest in problem eating behaviours.

It is also thought that social influence is important in food acceptance and rejection (Pelchat & Pliner, 1986), particularly children's likes and dislikes, which appear to be very influenced by others in their social environments (Pliner, 1983; Rozin et al., 1984; Pelchat & Pliner, 1986). Further, chaotic and disorganised environments (Cooper et al., 2004), family conflict (Chatoor et al., 1997; Cooper et al., 2004) and inappropriate modelling of eating behaviours (Galloway et al., 2003; Galloway et al., 2005; Blissett & Farrow, 2007) have all been associated with maladaptive feeding behaviours.

Previous risk factors identified for AN include pre-term birth, birth trauma, infant sleeping problems, childhood anxiety disorders, sexual abuse, timing of puberty, dieting, negative self-evaluation and perfectionism (see Jacobi et al., 2004 for a comprehensive review). Most of the models that have been developed are multi-factorial (e.g. Garfinkel & Garner, 1982) and often include general risk factors that are also shared with other eating disorders, including BN (Karwautz et al., 2001). These risk factors are both extrinsic and intrinsic and interact as predisposing, precipitating and maintaining factors for eating disorders (Karwautz et al., 2001).

### **The role of feeding practices**

One means of influencing children's eating behaviours is via the feeding practices employed by parents (Moore et al., 2007). Feeding practices are the specific strategies that parents use in an attempt to maintain or modify their child's eating style and diet (Ventura & Birch, 2008). These might include direct attempts to control the child's intake, for example pressuring the child to eat or restricting the intake of certain foods (Patrick et al., 2005). They also might include indirect attempts at exerting control, such as monitoring the child's intake on an ongoing basis or modelling healthy eating (Gregory et al., 2010; Ventura & Birch, 2008; Rhee, 2008).

## **Links between feeding practices, feeding disorders and eating disorder**

It would seem that parental feeding practices can affect a child's feeding behaviour through behavioural learning mechanisms (Sanders et al., 1993). Recent research has also indicated that feeding behaviours are established early and remain stable throughout childhood (Ashcroft et al., 2008). A number of studies observe the role of feeding practices and the continuity of eating problems within childhood (e.g. Fisher & Birch, 2002; Birch et al., 2003; Francis et al., 2004; Farrow & Blissett, 2012; Matton et al., 2013; Neumark-Sztainer et al., 2011). However, there appears to be a paucity in the literature beyond childhood; in particular, the role of early feeding practices in the development of later eating disorders.

Unfortunately as a result, the link between eating problems in children and later eating disorders remains inconclusive (Jacobi et al., 2003); relatively little is known about the course and progression of feeding problems over time and factors that promote or sustain abnormal eating, including feeding practices, are not yet completely understood (Kotler et al., 2001). The aim of this review, therefore, is to examine the literature on the links between early feeding disorders and later eating disorders and to consider how parental feeding practices may contribute to this.

## **METHODS**

### **Information Sources and Search Strategy**

Given the limited direct research into relationships between feeding practices and later eating disorder, two searches were conducted looking at links between feeding practices and feeding disorder, and between feeding disorder and eating disorder. Thus, any relationship between feeding practices and later eating disorders is hypothesised, based on these intermediate links.

Four electronic databases were searched: PsycINFO (1967 to the present day), Medline (from 1946 to the present day), Embase (1980 to current day) and PsycARTICLES. Searches took place between August and December, 2013. Searches included a combination of keywords and pseudonyms relevant to feeding practices, feeding disorder and eating disorder, which were then combined. This process, including the search limiters used, is illustrated in Table 1 and the search strategy is illustrated by Figure 1.

Table 1

Key term	Keywords/pseudonyms used	Search limiters used	Number of references found	Number of relevant references	Number of references used
Parental feeding practices	(PARENT* FEED* PRACTICE*) or (MATERNAL FEED* PRACTICE*)	Age group: up to 12 years Population group: human Language: English	121		
Feeding disorder	(FEEDING DISORDER) or (FEEDING DYSFUNCTION) or (FEEDING DIFFICULT*) or (FEEDING PROBLEM*) or (FEEDING BEHAVIO*) or (FEEDING PATHOLOG*) or (FOOD NEOPHOBIA*) or (PICKY EATING) or (PICKINESS) or (FADDINESS) or (FADDY EATING) or (FOOD AVOIDANCE) or (FOOD AVERSION) or (FOOD RESTRICT*) or (FOOD REFUSAL) or (SELECTIVE EATING) or (RESTRICTIVE EATING) or (AVOIDANT RESTRICTIVE FOOD INTAKE DISORDER) or (INFANTILE ANOREXIA)	Age group: up to 12 years Population group: human Language: English	15511		
Eating disorder	(EATING DISORDER) or (EATING PSYCHOPATHOLOG*) or (EATING PATHOLOG*) or (EATING DYSFUNCTION) or (EATING DIFFICULT*) or (EATING PROBLEM*) or (ANOREXIA) or (BULIMIA)	Age group: 13-65 years Population group: human Language: English	64652		
Parental feeding practices AND feeding disorder		Duplicates removed	88	56	<b>11</b>
Feeding disorder AND eating disorder	AND (CONTIN*) or (LONGITUDIN*) or (PROSPECTIVE) or (RETROSPECTIVE) or (RELATIONSHIP) or (DEVELOPMENT) or (ASSOCIATION)	Duplicates removed	827	36	<b>6</b>

Search Strategy



## **Criteria for Inclusion**

From the first search, articles were included that focussed on feeding practices engaged in by Western mothers of Western children, under the age of 12 years. It was decided to focus only on Western families as research has shown how cultural rites and religious cosmology result in significant variation in feeding practices (Southall & Martin, 2010), which is beyond the scope of this review. Due to the difficulty classifying feeding disorder, articles referring to the most prominent classifications used were included (see Table 1).

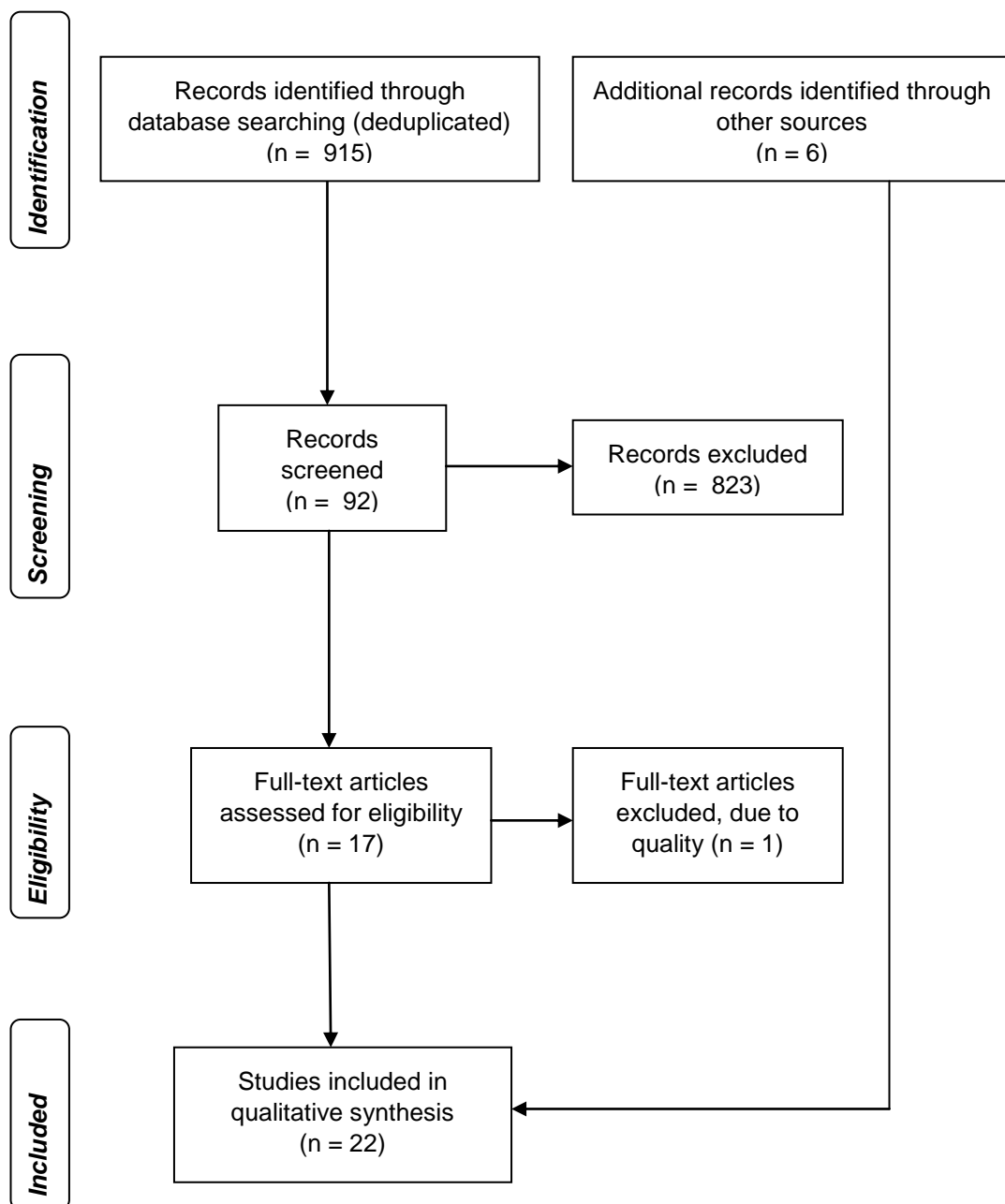
Evidence of problematic feeding behaviours as shown by standardised measures (e.g. the Child Feeding Questionnaire (Birch et al., 2001)), was required for inclusion. Inclusion did not require the presence of a diagnosis as studies have shown that the majority of children referred for feeding problem interventions do not meet the diagnostic requirements of a feeding disorder (e.g. Williams et al., 2009). Articles relating to neurological or developmental conditions were not included, as the aetiology of feeding disorder in these groups is more around sensory issues, anatomical complications or general neurocognitive delay, rather than psychological factors. Further, articles with the predominant focus on obesity were excluded, as obesity is not considered a feeding or eating disorder by modern classification systems and this topic is covered extensively elsewhere.

Feeding practices were understood as “specific strategies that parents use in an attempt to maintain or modify their child’s eating style and diet” (Ventura & Birch, 2008) and did not include wider feeding behaviours such as bottle versus breastfeeding or time of weaning. Problems with feeding that develop at the weaning phase are largely considered to stem from physical and behavioural changes, such as oral-motor control and reduction in oral sensitivity (Aldridge et al., 2010) rather than psychological and so are not included here.

For the second search, articles focussing on links between childhood feeding and later eating disordered behaviours along a significant timeframe were included. Again, articles including Western populations, referring to the most prominent classifications of feeding disorder were included. With respect to later eating disorders, articles referring to either general eating disorder or more specific AN or BN were included. Again, prior diagnosis in the population was not required, but evidence of eating disorder behaviours, symptoms or psychopathology was, shown by standardised measures (e.g. the Structured Interview for Anorexia Nervosa and Bulimic Syndromes (Fichter et al., 1998)).

From both searches, articles were excluded if they were referring to feeding and eating problems associated with organic, medical conditions or naso-gastric tube-feeding. This is because these children are not categorised in the same way as non-organic cases as the problems, onset, prognosis and treatment are different (Budd et al., 1992).

Figure 1



PRISMA flow diagram for illustrating literature selection

Applying the inclusion criteria resulted in the exclusion of 75 of the 92 original articles, leaving a total of 17. The reference lists of these retrieved resources were then manually searched to identify additional documents. This resulted in an extra six references being included in the review; four relevant to the links between feeding practices and feeding disorder and two relevant to the continuity of feeding and eating disorder. This process is illustrated by Figure 1, using an adapted version of Moher and colleagues' (2009) PRISMA flow diagram.

### **Data Extraction & Quality Assessment**

Pertinent information from each article was extracted and recorded into Table 2. This allowed comparison of study design, sample size, procedure, measures and relevant findings. Information regarding the population of the sample was also included; age of the children investigated, nationality, ethnicity, socio-economic status and any information regarding exclusion criteria (often food allergies), where detailed. The key for the data extraction table is found in Appendix 2.

Table 2

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Carper et al., 2000</b>	Cross-sectional analysis	Total $n=197$ (197 mothers 194 fathers)	American 5-yr old girls & parents 99% Caucasian All middle-class 2-parent families No food allergies, dietary restrictions or medical problems	1:1 structured interviews with girls Self-report questionnaires for parents	KCFQ (own) - Restriction & Pressure,  DEBQ (age-adapted)  CFQ-Restriction & Pressure	Pressure & restriction co-occur  Child's perceptions of pressure positively correlated with restrained & disinhibited eating  Child's perceptions of restriction negatively correlated with external disinhibited eating No correlation between parental restriction & child's restraint or emotional (internal) disinhibition
<b>Chatoor et al., 1987</b>	Observational analysis – case control study	Total $n=72$	American, 7mo-3yrs (mean 20mo) & 52% female  Met criteria for infantile AN ( $n = 42$ ) or control ( $n = 30$ )  8 with organic problems  72% middle-class  67% Caucasian	20min feeding, 10min play sessions observed in clinic (one-way mirror) & video-taped by 2 observers	Global Likert rating scales for feeding & play behaviours	Significant differences between groups during feeding: dyadic reciprocity (higher in control) conflict, struggle for control & maternal non-contingency (higher in FD group)  Significant differences between groups during play: dyadic reciprocity (higher in control) unresponsiveness, conflict & intrusiveness (higher in FD group)

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Galloway et al., 2005</b>	Observational analysis - Longitudinal (2 years) & cross-sectional analyses	Total <i>n</i> =173  T1 = 192 T2 = 183	American Caucasian girls & mothers  7yrs (T1) & 9yrs (T2)  From 2-parent families  No food allergies, dietary restrictions or medical problems	1:1 structured interviews for girls  Self-report questionnaires for mothers  Two time points: T1 data used as predictors, T2 data as outcome	CFQ-Pressure (T1)  CFQ-Picky Eating (T2)  FFQ for mothers (T1)	Maternal pressure (at T1) higher in picky eating group (at T2)
<b>Gregory et al., 2010</b>	Prospective analysis (12 months)	Total <i>n</i> =156	Australian mothers of 2-4 year old children – recruited from The Child & Family Health Study (cohort study)  87% married or in permanent relationship  60% middle class (by education)  Children 51% female	Postal questionnaires Two time points (12 months apart)	CFQ-Pressure, Restriction & Monitoring  3 bespoke questions re. modelling strategies  CEBQ- Fussiness, Food Responsiveness & Interest in Food	FP added to variance in fussiness & interest in food, but not food responsiveness  Pressure associated with: higher fussiness @ T1 & T2, lower interest @ T1 & T2  Restriction associated with: higher responsiveness @ T1 & T2, higher fussiness @ T2, lower interest @ T2  Modelling associated with: higher interest @ T2, lower responsiveness @ T2, lower fussiness @ T2

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Jansen et al., 2012</b>	Cross-sectional cohort study	Total <i>n</i> =4987  Individual analyses with smaller <i>n</i>	Mothers of 4-yr-old children (50% male)  Recruited from Generation R cohort study (67% Dutch)  Middle class sample – education & income higher than norm	Postal questionnaires	CEBQ  CFQ-Pressure, Restriction & Monitoring	Correlations between: food responsiveness & restriction (+ve) satiety responsiveness & pressure (+ve) enjoyment & pressure (-ve) Monitoring & fussiness (-ve)  BMI positively predicted by restriction & negatively predicted by pressure. No association with BMI.  FP explained 43% of the correlation between fussiness & BMI
<b>Lewinsohn et al., 2005</b>	Cross-sectional analysis	Total <i>n</i> =93	American (?) young mothers ( <i>M</i> = 29yrs) of children 36-37 months old, 60% female  Recruited from Oregon Adolescent Depression Project  28% completed higher education  96% Caucasian  Organic ( <i>n</i> =1)	Questionnaires in clinic	Created own questionnaire (ORI-CEBI): picky eating, food refusal, parent behaviour & struggles for control  CBCL (@ 24 months)  Vineland ABS (Sparrow et al., 1984)	+ve correlations between: pickiness & struggle for control refusal & struggle for control, struggle for control & BMI  No correlation between ABS & ORI-CEBI but +ve correlation between struggle for control & externalising behaviour, withdrawal, aggression & destructive behaviour (CBCL)  Maternal axis 1 disorders -vely correlated with food refusal, alcohol dependence +vely correlated with pickiness

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Matton et al., 2013</b>	Prospective (6 months)	613 children	Flemish (Belgian) sample	Questionnaires administered in school class, by RAs	ChEDE-Q	Loss of control, overeating, restraint & cognitive concerns were stable from T1 to T2
		714 parents	Recruited from schools		CFQ	Interaction between gender of child & maternal pressure @ T1 predicted increases in overeating @ T2 – only in girls
		(411 mothers, 303 fathers)	All middle class Children 8-11yrs & 49% female			No main effect of pressure & no significant gender difference in amount of pressure used. No other results re. FPs
<b>McPhie et al., 2011</b>	Cross-sectional analysis	Total n=175	Australasian (90%) mothers of 2-5-yr-olds, 54% female	Postal questionnaires	PSQ-Warmth & Control	Pressure correlated & predicted fussiness (+ve) & food enjoyment (-ve) but not BMI
			Recruited via adverts in schools & community settings		PSI-PCDI	Restriction not correlated or predicted fussiness, enjoyment or BMI
			Middle class - education		CFQ	
					CEBQ-Fussiness & Food Enjoyment	Maternal warmth negatively correlated with BMI  Dysfunctional interaction not correlated with child fussiness or food enjoyment but predicts BMI  Monitoring positively correlated with BMI but not fussiness or food enjoyment.



	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Moroshko &amp; Brennan, 2012</b>	Cross-sectional analysis	Total $n=90$	Australian mothers of 2-5-yr-olds, 46% female  Recruited from community settings  No dietary needs  Mainly middle class (83% higher education)	Online questionnaires	CFSQ-Authoritarian  CFQ-Pressure & Restriction  CFNS Picky Eating Scale (Galloway et al., 2005)	Overall bivariate correlations between FP & eating patterns but no associations with weight.  Neophobia correlated with authoritarian feeding, pressure & restriction  Picky eating correlated with authoritarian feeding  Authoritarian feeding, restriction & pressure combined predicted neophobia & pickiness. No individual predictors of neophobia or pickiness.
<b>Pelchat &amp; Pliner, 1986</b>	Cross-sectional analysis	Total $n=79$	Canadian mothers of 2-7-yr-olds, 51% female  Recruited from research database, community & acquaintances  All 2-parent families  33% higher education	Postal questionnaires	Authors' own questionnaires – demographics, introduction of solids, parents' eating, parents' feeding (child input, contingency & diversity) & psychological/behavioural problems	Correlation between feeding problems & contingency (+ve) & dietary diversity (-ve)  Correlation between neophobia & dietary diversity (-ve) & child input into meals (+ve)  Correlation between contingency & perception of feeding problems (+ve)  Correlations between feeding problems & acting out, toileting & fearfulness (+ve)

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Powell et al., 2011</b>	Cross-sectional analysis	Total <i>n</i> =104	English (?) mothers of 3-6-yr-olds  40% female, 51% male, 9% undisclosed  89% White British  Recruited from community settings (schools/nurseries)  Wide SES range	Postal questionnaires via schools & nurseries	CEBQ-Food avoidance  CFPQ-Control, Food for Behaviour Regulation & Environment  DEBQ-Restraint  EAS	Correlation between fussiness & pressure (+ve), restriction for health (+ve) - predictor, monitoring (-ve) & maternal restraint (+ve) but not using food as reward  Correlations between: pressure & slow eating (+ve) - predictor, pressure & emotional undereating (+ve) – predictor, pressure & satiety responsiveness - predictor, reward & emotional undereating (+ve), reward & satiety responsiveness
<b>Rigal et al., 2012</b>	Cross-sectional analysis	Total <i>n</i> =502  Individual analyses with smaller <i>n</i>	French-speaking mothers of children 20-36-months-old  Recruited from day-care centres (78%) & the Opaline cohort study (22%)  SES varied  89% 2-parent families	Postal questionnaires	Developed own questionnaires re. feeding behaviours & feeding practices (strategies, styles & motivations)	25-36-month-olds perceived more difficult to feed than 20-24  Child seen more problematic when FP are driven by child preferences  Permissive style, coercion, contingency, motivations & strategies for child preferences all predictors of feeding difficulties (15-22% variance)

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Sanders et al., 1993</b>	Observational analysis – case control study	Total $n=45$	<p>Australian (?) mothers of 12-72 month olds (43% girls)</p> <p>FD group recruited from specialist clinic. Controls recruited from nurseries/schools</p> <p>4 groups: 12-36 months feeding disordered (<math>n=12</math>), 1-3yrs controls (<math>n=7</math>), 3-6yrs feeding disordered (<math>n=11</math>) &amp; 3-6yrs controls (<math>n=15</math>)</p> <p>No organic problems</p>	<p>20min feeding session in clinic, video-taped</p> <p>Tapes coded by 3 observers (one as control)</p>	<p>MOS – revised</p> <p>Parent diary of home mealtime behaviours</p> <p>DAS (marital disharmony)</p> <p>BDI</p> <p>PSSI</p>	<p>Feeding problems significantly associated with more disruptive behaviour at mealtimes</p> <p>Aversive &amp; non-aversive maternal behaviour contributed to child's disruptive behaviour (25% variance) in both groups</p> <p>Aversive maternal behaviour (-ve vague instruction, -ve physical contact, -ve prompting, -ve comments &amp; -ve social attention) higher in FD group</p> <p>Individual eating behaviours correlate with specific parent behaviours: food refusal &amp; nonaversive vague instruction (+ve), non-compliance &amp; all aversive behaviour (+ve), non-compliance &amp; non-aversive vague instruction (-ve), playing with food &amp; -ve physical contact, -ve instructions, -ve eating comments &amp; -ve social attention (all +ve)</p> <p>No effect of marital disharmony, depression or social support</p>

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Tan &amp; Holub, 2012</b>	Cross-sectional analysis	Total $n=85$	American (?) mothers of 3-12-yr-olds (52% female)	Postal (?) questionnaires	CFNS	Mothers of girls used more food as emotion regulation & child involvement
			85% Caucasian		FNS	
					CFPQ-Controlling & autonomy promoting	Restriction (for health) correlated with neophobia (+ve)  Pressure, restriction (for weight), modelling, child involvement, child control, food as emotion regulation nor food as reward correlated with neophobia  Autonomy promotion (environment & monitoring behaviours) correlated with neophobia (-ve)
<b>Webber et al., 2010</b>	Cross-sectional analysis	405 children	English mothers & children (mean age 8yrs, 48% female)	Postal questionnaires	CEBQ-Food approach & food avoidance	Restriction correlated with food responsiveness (+ve) but not food enjoyment, fussiness, satiety responsiveness or slow eating
		213 mothers	Recruited from Physical Exercise & Appetite in Children Study (cohort study)		CFQ-Pressure & Restriction	Pressure correlated with satiety responsiveness (+ve), fussiness (+ve), food enjoyment (-ve) & slow eating (+ve) but not food responsiveness
			62% Caucasian  48% highly educated			

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Dellava et al., 2012</b>	Retrospective study	186 families (mothers)	English or German-speaking American female adults & relatives with AN & mothers	Diagnostic interviews (x2) of affected individuals	SCID SIAB	No measure of infant feeding, childhood picky eating or infant gastrointestinal problems predicted AN subtypes
		325 individuals (121 sisters & 46 other relatives)	Recruited from Genetics of AN cohort study	Retrospective questionnaire for mothers	European Healthy Eating Project questionnaire	Picky eaters (0-1yrs) constituted 24% of AN sybtypes  Picky eaters (1-5yrs) constituted 37% of AN subtypes
			16yrs or older (mean age 26yrs)			
			Range of education			

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Kotler et al., 2001</b>	Prospective cohort study	Over 800	American mothers of children in a cohort study  Recruited from community settings  91% Caucasian  Middle-class sample	4 time points – age 1-10yrs, 9-18yrs, 11-20yrs & 18-27yrs	Own questionnaire: mealtimes & struggles, picky eating, amount eaten, eating speed & interest in food  DISC (mothers & children) @ T2 & T3  DISC (just children) @ T4	BN & AN symptoms correlated between T2 & T4 (+ve)  No significant T1 predictors of T4 problems  AN/BN symptoms are correlated between T2, T3 & T4 especially when more severe  Eating conflict, struggles with food & unpleasant meals in childhood predicted later AN symptoms  Food refusal, low interest in food, picky eating & slow eating not significant predictors of AN  Struggles with food predicted BN symptoms but no significant predictors of BN  Eating too little protected against BN symptoms

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Marchi &amp; Cohen, 1990</b>	Prospective cohort study	Total <i>n</i> =659	American community sample  Mothers of children (49% female)  Range of education & SES	3 time points - age 1-10yrs, 9-18yrs, 11-20yrs	Own interview: mealtimes & struggles, picky eating, amount eaten, eating speed & interest in food - Combined into 2 factors: problem meals & pickiness  Maternal interviews: pica, gastrointestinal problems & food avoidance  DISC (mothers & children) @ T2 & T3	Pickiness & problem meals stable between T1 & T3, AN/BN symptoms stable between T2 & T3  Early pickiness (T1) predicted later AN symptoms at T2 (+ve). T2 pickiness predicted AN symptoms at T3  Problem meals not a significant predictor of AN but is of BN  Early Pica (T1) predicted later BN symptoms @ T2 & pickiness is protective  Mealtime struggles associated with later food avoidance

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>McDermott et al., 2010</b>	Longitudinal cohort study	<i>n</i> =7223 @ T1  <i>n</i> =4554 @ T2	Recruited from Mater-University Study of Pregnancy cohort study  Australian (?) mothers of newborns	2 time points of interest – 6 months & 14yrs  Postal (?) questionnaires	Own structured interviews re. eating behaviours  DSSI (maternal anxiety/depression)	Rate of eating problems similar across time (28% & 27%) - feeding problems @ T1 associated with eating problems @ T2  Internalising/externalising problems & difficulties with self-regulation significant factors  Maternal anxiety from 6mo-5yrs (depression nearly significant) predictor of eating problems but not parenting style
<b>Micali et al., 2007</b>	Retrospective case control study	Total <i>n</i> =150 pairs	Recruited from clinical & community settings across Europe (4 centres)  50%+ Austrian, 25% Spanish, 19% UK, 6% Slovenian, 99% Caucasian  Diagnosed adults (AN/BN, mean age 24yrs) & sisters (<10yrs apart)	Postal questionnaires	EATATE interview  Authors' Infant & Childhood Feeding & Eating Questionnaire	Selective/picky eating, undereating, meal struggles, slow/fast eating (before 10) not associated with adult AN  Eating quickly & eating a lot significant predictors of adult BN  Picky eating protective against adult BN  Low weight at 6 months predicted adult AN



	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Nicholls &amp; Viner, 2009</b>	Longitudinal case control cohort study	<p><i>n</i>=16567 @ T1</p> <p><i>n</i>=13135 @ T2</p> <p><i>n</i> =14875 @ T3</p> <p><i>n</i>=11261 @ T4</p> <p>10906 used in analysis</p>	<p>Recruited from 1970 British Cohort Study</p> <p>Non-clinical population (<i>n</i>=101 with AN)</p>	4 time points – 0-6months, 5yrs, 10yrs & 30yrs	<p>Self-report online questionnaire re. eating disorder @ T4</p> <p>Other data from cohort study Rutter Malaise Inventory</p>	<p>Feeding problems @ T1 significantly differed between AN &amp; non-AN (22% v 13%) &amp; predicted AN risk but not @ T2 or T3, including faddiness</p> <p>Undereating @ T3 significantly differed (10% v 5%) &amp; predicted AN risk</p> <p>AN risk predicted by separations from mother by T2 &amp; maternal psychological morbidity @ T2 but not T3</p> <p>Emotional &amp; conduct problems, psychological morbidity, authoritarian views &amp; sleep problems all insignificant predictors</p>

	Study Design	Sample Size	Population	Procedure	Measures	Findings
<b>Rydell &amp; Dahl, 2005</b>	Cross-sectional & longitudinal case control study	N=67 @ T1	Swedish (?)	Two time points – 3-12 months & 16yrs	ChEAT	No significant differences between groups (eating attitudes or –ve self-perceptions) @ T2
		N=54 @ T2	Clinical group from healthcare units (n=25 @ T1, 19 @ T2) & control group from same units (n=42 @ T1, 35 @ T2)  60% female @ T1	Questionnaires in clinic  Mealtime observations at home	I Think I Am (self-perception) test (Ouvinen-Birgerstam, 1999)  Structured interviews with mothers – feeding problems (food refusal, length of problems, maternal perception of the problem & infant mood during feeding)	Feeding problems @ T1 predicted low BMI @ T2 in clinical group but not eating attitudes or self-perceptions  Low birthweight predicted disturbed eating attitudes & –ve self-perceptions at T2  Less +ve self-perceptions at T2 marginally associated with behaviour problems at T1 but not BMI or eating attitudes

Data extraction table

Both Fox and Joughin's (2002) and Caldwell and colleagues' (2005) quality criteria were informally applied in the analysis of the literature. These are presented in Appendix 3 and 4, respectively. Fox and Joughin's (2002) criteria were chosen as they were used in their literature review of childhood eating problems and so it was assumed that they would be relevant to the articles reviewed here. Caldwell and colleagues' (2005) criteria were also chosen, as they were developed specifically for health-related research.

The analysis of each article included the consideration of issues such as methodological quality (study design, sample size, population, procedure, outcome measures), statistical issues, validity and quality of reporting. Validity included consideration of possible biases (including allocation, performance, detection and attrition), data collection, data analysis, interpretation of findings and generalisability. Due to the limited literature in this area, quality assessment was not explicitly used as an exclusion criterion, although limitations are discussed later. This was with the exception of one article, which used an unacceptably small sample size, did not use standardised feeding questionnaires and did not perform any statistical analysis.

The final number of articles included in the review, therefore, is 22, with 15 focussing on the role of feeding practices in the development of childhood feeding problems and seven articles focussing on the continuity of feeding problems into the development of later eating disorder.

## **RESULTS**

### **Sample Characteristics**

Eight of the 22 studies used an American sample, one used a Canadian sample, five used an Australasian sample and eight used a European sample, which included three English samples. The mean sample size was 1,243 participants but this is skewed by the larger sample sizes of cohort studies; the median sample size is 192 participants. 15 studies included children up to five-years-old and 12 studies included children up to the age of 16 years. Across all studies, the mean age of participants under 16 years was 6.1 years and where participants were over 16 years ( $n = 8$ ), the mean age was 20.9 years, with a maximum age of 30 years.

### **Study Design and Methods**

Studies consisted of cross-sectional analyses ( $n = 10$ ), observational studies, ( $n = 2$ ), longitudinal analyses ( $n = 8$ ) including four prospective analyses, and retrospective studies ( $n = 2$ ). Longitudinal analyses were considered to include follow-up time points more than two years apart (for example, between one and ten years old (Kotler et al., 2001; Marchi & Cohen, 1990) or between six months

and 14 years (McDermott, 2010)); those studies with follow-up time points less than this are discussed under cross-sectional analyses.

The majority of studies ( $n = 16$ ) used questionnaires with parents as their main method of data collection. Two studies used interviews with parents and nine studies used interviews or questionnaires with the 'affected' individuals (i.e. those with feeding or eating difficulties). Two studies used direct observation methods.

### **Cross-Sectional Studies**

All cross-sectional studies investigated relationships between parent feeding practices and aspects of child feeding, including fussy or picky eating, food refusal, neophobia, food enjoyment, interest and responsiveness, satiety responsiveness, dietary restraint and disinhibited eating between the ages of two and eight years. Overall, the cross-sectional studies show significant associations between feeding practices and child eating patterns (Moroshko & Brennan, 2012; Powell et al., 2011). Only two studies (Tan & Holub, 2012; Matton et al., 2013) showed no association between feeding practices and eating behaviour.

Three studies showed a significant contribution of feeding practices to child fussiness specifically (Gregory et al., 2010; McPhie et al., 2011; Powell et al., 2011), with two of these (McPhie et al., 2011; Powell et al., 2011) finding that feeding practices alone accounted for between eight and 13% of the variance in fussiness. Gregory and colleagues (2010) found that feeding practices significantly contributed to interest in food in 2-4-year-olds and McPhie and colleagues (2011) found that feeding practices accounted for 17% of the variance in food enjoyment.

Carper and colleagues (2000) found that pressure-to-eat correlated positively with 5-year-olds' restrained but also disinhibited eating. Further, five studies (Galloway et al., 2005; Gregory et al., 2010; McPhie et al., 2011; Powell et al., 2011; Webber et al., 2010) found associations between pressure-to-eat and fussier or pickier eating. Moroshko and Brennan (2012) found an association between neophobia and the combined use of pressure, restriction and overall authoritarian feeding.

Four studies found a correlation between pressure-to-eat and lower enjoyment (Jansen et al., 2012; McPhie et al., 2011; Webber et al., 2010) or interest (Gregory et al., 2010) in food. Three studies (Jansen et al., 2012; Powell et al., 2011; Webber et al., 2010) also found a correlation between pressure-to-eat and higher satiety responsiveness; supported by the findings that pressure-to-eat is significantly associated with lower BMI (Jansen et al., 2012; Gregory et

al., 2010). Two studies (Powell et al., 2011; Webber et al., 2010) found a correlation between pressure-to-eat and slower eating.

Three studies (Gregory et al., 2010; Jansen et al., 2012; Webber et al., 2010) found significant positive correlations between the use of restriction and food responsiveness. This was supported by both Jansen and colleagues' (2012) finding that restriction significantly predicted higher BMI. In contrast, a significant association was also found between restriction and lower interest in food (and therefore lower food responsiveness) by Gregory and colleagues (2010). Similarly, one study (Carper et al., 2000) found that parents' report of restriction was not associated with child's disinhibition (and therefore food responsiveness). Further, child's perception of parental restriction was actually associated with lower disinhibited eating in response to external cues.

Three studies (Gregory et al., 2010; Powell et al., 2011; Tan & Holub, 2012) found an association between restriction and fussier eating, including neophobia (Tan & Holub, 2012). Both Powell and colleagues (2011) and Tan and Holub (2012) found that this association was only with restriction for health purposes and did not exist with restriction for weight purposes. In contrast, McPhie and colleagues (2011) found no significant effect of the use of restriction, either on fussiness, food enjoyment or BMI. Moroshko and Brennan (2012) found that only the combination of restriction, pressure and authoritarian

feeding predicted neophobia but none of these were individually significant predictors.

With regards to other feeding practices, Gregory and colleagues (2010) found that parental modelling was associated with higher interest in food, less fussiness and lower food responsiveness. However, Tan and Holub (2012) found no association between modelling and neophobia. Three studies (Pelchat & Pliner, 1986; Powell et al., 2011; Rigal et al., 2012) found associations between feeding problems and the use of reward-based strategies. For example, Powell and colleagues (2011) found an association with emotional under-eating and satiety responsiveness, but not fussiness. Parental monitoring was found to be associated with fussiness in one study (Jansen et al., 2012) but not another (McPhie et al., 2011). Powell and colleagues (2011) found correlations between emotional undereating and the use of food as emotional regulation. Finally, Lewinsohn and colleagues (2005) found a correlation between maternal alcohol dependence and higher pickiness and a correlation between maternal psychological disorders and lower food refusal.

When measuring more general feeding styles, Moroshko and Brennan (2012) found that authoritarian feeding was associated with both neophobia and picky eating but a more permissive style was also associated with feeding difficulties in other studies. For example, higher levels of neophobia were associated with children having higher input into meals (Pelchat & Pliner, 1986) and more



problematic meals and feeding difficulties were associated with feeding practices which were driven by child preferences (Rigal et al., 2012). Lewinsohn and colleagues (2005) found that struggle for control between parent and child was associated with child's pickiness and food refusal, as well as general behavioural problems. On the other hand, the encouragement of autonomy was found to correlate with lower levels of neophobia in Tan and Holub's (2012) study.

### **Observational Studies**

Both observational studies investigated mother-child interactions during feeding and found significant differences between an affected group (with feeding difficulties) and a non-affected group. Over both groups, Sanders and colleagues (1993) found that maternal behaviours significantly contributed 25% of the variance in child's disruptive feeding behaviour. Chatoor and colleagues (1987) named "dyadic reciprocity" as lower in the affected group and conflict, struggle for control and maternal non-contingency higher. Similarly, "aversive maternal behaviour" (including negative instruction, physical contact, prompting, comments and social attention) was found to be significantly higher in Sanders and colleagues' (1993) affected group.

Sanders and colleagues (1993) also found that specific parent behaviours correlated with individual eating behaviours. For example, vague instructions

were positively correlated with food refusal and all aversive maternal behaviours were positively correlated with non-compliance. Various aversive maternal behaviours (negative physical contact, instructions, eating comments and social attention) were also positively correlated with playing with food.

### **Longitudinal Studies**

Five of the eight longitudinal studies investigated feeding problems observed during early childhood and their presentation in later childhood and adulthood. The remaining three studies (Galloway et al., 2005; Gregory et al., 2010; Matton et al., 2013) followed feeding practices and feeding difficulties for less than a two-year period and so have been discussed within the cross-sectional studies.

Findings were similar across all six longitudinal analyses, showing a stability in feeding problems and eating difficulties across infancy (0-12 months), early childhood (1-10 years), adolescence (14-18 years) and even adulthood (18-30 years). McDermott and colleagues (2010) found that the rate of feeding problems were similar across six months and 14 years, with the earlier feeding problems being significantly associated with later eating problems at 14 years. Marchi and Cohen (1990) also found that pickiness and problem meals were stable across childhood and into adulthood.

In terms of eating disorders, Kotler and colleagues (2001) found that BN and AN symptoms correlated with each other between mid-adolescence (9-18 years) and young adulthood (18-27 years). Marchi and Cohen (1990) also found that AN and BN symptoms are stable between childhood and adolescence. Kotler and colleagues (2001) found that eating conflict, struggles with food and unpleasant meals in childhood were all significant predictors of adult AN symptoms. Marchi and Cohen (1990), however, found that problem meals were not a significant predictor of AN but childhood picky eating was.

Both Kotler and colleagues' (2001) and Marchi and Cohen's (1990) studies found that childhood struggles with food and problem meals also predict adolescent BN symptoms, whilst eating too little and pickiness appear to protect against BN symptoms. There were no other significant predictors of BN in Kotler and colleagues' (2001) study, including food refusal, low interest in food, picky eating and slow eating. However, Marchi and Cohen (1990) found that childhood pica significantly predicted later BN symptoms.

Nicholls and Viner (2009) found that 30-year-olds with AN showed significantly more feeding problems before six months old, including faddy eating, and that this significantly predicted the development of their illness. However, they also found that the prevalence of eating problems at five years and faddy eating at ten years were similar across affected (diagnosed with AN at 30 years) and non-affected groups and did not significantly predict the development of AN.

Similarly, no significant differences were found between an affected group (early childhood feeding problems) and non-affected group at 16 years in eating attitudes (Rydell & Dahl, 2005).

### **Retrospective Studies**

Both retrospective studies investigated recalled childhood feeding difficulties of a sample with current eating disorder (AN) diagnosis. Dellava et al. (2012) found that picky eaters at 0-12months constituted 40% of the affected individuals and between one and five years constituted 23%. However, both studies found that no measures of early feeding problems (both at 0-12 months and between one and ten years), including picky eating, selective eating or meal struggles, were significantly associated with an eating disorder diagnosis in adulthood. The only significant predictor of eating disorder found was low weight at six months predicting later AN (Micali et al., 2007), with picky eating appearing to protect against later BN (Micali et al., 2007).

## **DISCUSSION**

### **Overview of Findings**

The literature reviewed here firstly provides evidence for a significant contribution of maternal feeding practices to a child's eating behaviour (e.g. Moroshko & Brennan, 2012), including fussiness (Gregory et al., 2010; McPhie et al., 2011; Powell et al., 2011), interest in food (Gregory et al., 2010), enjoyment of food (McPhie et al., 2011), slow eating, emotional undereating and satiety responsiveness (Powell et al., 2011). Further, there appear to be observable differences between the feeding practices used in feeding-disordered and non-feeding-disordered groups (Sanders et al., 1993; Chatoor et al., 1987).

The majority of evidence points towards associations between authoritarian feeding practices and feeding difficulties. Seven studies demonstrate associations between pressure-to-eat and fussiness (Gregory et al., 2010; McPhie et al., 2011; Powell et al., 2011; Galloway et al., 2005; Webber et al., 2010; Moroshko & Brennan, 2012) and four studies link restriction with fussiness (Gregory et al., 2010; Powell et al., 2011; Tan & Holub, 2012; Moroshko & Brennan, 2012), with only one study opposing this (McPhie et al., 2011).

Feeding problems are shown to be associated with both pressure-to-eat and restriction (Gregory et al., 2010; Powell et al., 2011; Moroshko & Brennan, 2012), which may be explained by the finding that pressure-to-eat and restriction tend to co-occur (Carper et al., 2000). For example, parents potentially employ restrictive practices to limit the consumption of 'unhealthy' foods whilst also using pressure-to-eat to encourage consumption of 'healthy' foods.

There is also substantial evidence for the association of reward-based strategies and feeding difficulties (Pelchat & Pliner, 1986; Powell et al., 2011; Rigal et al., 2012), including emotional under-eating (Powell et al., 2011). Permissive feeding styles (Rigal et al., 2012), particularly where the child's input or preferences are paramount, also appear to be more commonly associated with child feeding problems such as neophobia and picky eating (Moroshko & Brennan, 2012; Rigal et al., 2012; Pelchat & Pliner, 1986; Powell et al., 2011).

One consideration regarding reward-based strategies is the content of the reward. Research has shown that the use of food-based rewards for the consumption of foods actually decrease liking for the encouraged food and increases the desire for the reward even more (Birch et al., 1984; Moore et al., 2007) through negative reinforcement (Dovey, 2010). However, psychological, social or emotional rewards do not seem to provoke this process and can be effective. For example, praise (Birch, 1980) and playing games, which induce

positive emotion (Wardle et al., 2003). It may be that the rewards referred to in the studies reviewed here involved food as the reward rather than psychological, social or emotional rewards, but this is not made clear.

## **A Proposed Model**

Feeding problems can be understood in terms of two constructs; disinhibited eating and restrained (or inhibited) eating (Stunkard & Messick, 1985). From this review, the trend appears to be towards the disinhibited style of eating, indicated by higher food responsiveness and higher BMI, when restrictive feeding practices are employed. The trend appears to be towards the restrained style of eating, indicated by lower interest and enjoyment of food, higher fussiness and lower BMI, with pressure-to-eat.

It is arguable that the eating disorders AN and BN are extreme presentations of these eating behaviour constructs, with AN constituting extreme restrained eating and BN characterised by extreme disinhibited eating. This is supported by the findings here that early pickiness and faddy eating often correlate with later symptoms of AN (Marchi & Cohen, 1990; Nicholls & Viner, 2009), whilst early pica (ingestion of non-food, non-nutritional substances) can predict symptoms of BN (Marchi & Cohen, 1990).

It would seem, therefore, that rather than maternal feeding practices directly resulting in specific feeding problems or eating disorders, they may contribute to the development of an eating style in the child along the disinhibited-restrained continuum. These feeding practices may be the result of a variety of factors, including parental mental health state (Blissett et al., 2007; Coulthard & Harris, 2003; Greer et al., 2008; Martin et al., 2013), parent-child relationship (e.g. Lucarelli et al., 2013; Chatoor, 2002; Sanders et al., 1993; Chatoor et al., 1987; McPhie et al., 2011) or general parenting style.

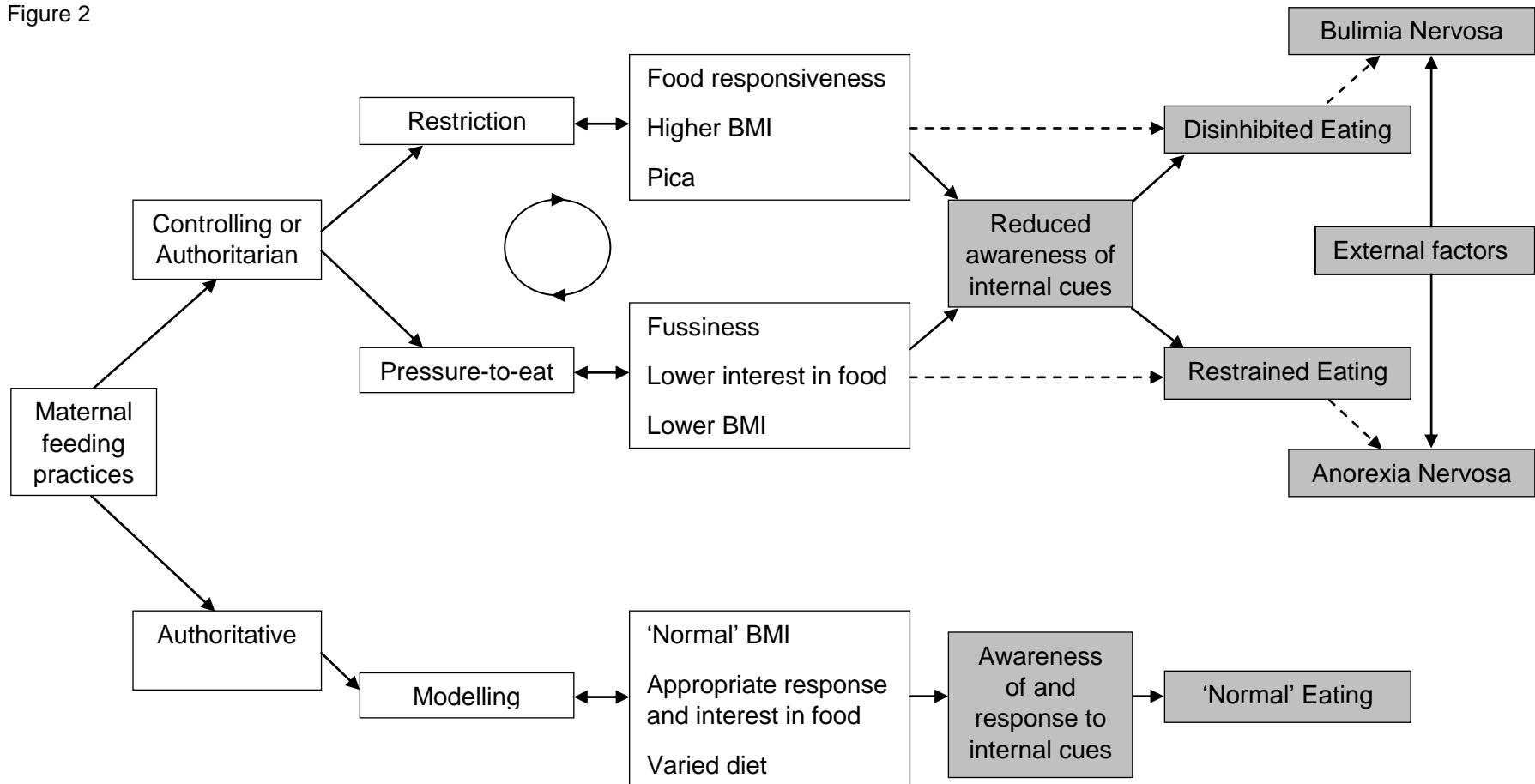
Authoritarian feeding practices appear to be a particular factor in the development of disinhibited and restrained styles of eating. It is hypothesised that both disinhibited and restrained styles of eating interfere with the child's attendance to internal cues of hunger and satiety (Carper et al., 2000), which results in the specific feeding difficulties that characterise the eating style, such as fussy eating or food responsiveness. This hypothesised model is summarised by the grey portion of Figure 2.

To support this, there is evidence that feeding problems are continuous within childhood (Gregory et al., 2010; Matton et al., 2013; McDermott et al., 2010; Nicholls & Viner, 2009; Kotler et al., 2001). There is also some evidence of a longer-term continuity from feeding problems such as picky eating, pica and mealtime struggles in childhood to later eating disorder symptoms (Marchi & Cohen, 1990; Nicholls & Viner, 2009; Kotler et al., 2001). Interestingly, whilst



finding an association between adult eating disorder symptoms and feeding problems at under six months old, one study (Nicholls & Viner, 2009) found no evidence of feeding problems in the interim years. This potentially implies a possible 'settling down' period, where feeding problems reduce to a 'normal' level. The proposed model hypothesises, however, that the underlying eating style remains stable and can later emerge as an eating disorder; perhaps due to external factors. This is also demonstrated by the grey portion of Figure 2.

Figure 2



Proposed model to explain relationship between feeding practices, feeding problems and eating disorder

## **Direction of Association**

An important consideration is the direction of causality between feeding strategies and feeding problems. Many studies here showed associations between feeding practices and feeding problems (e.g. Carper et al., 2000; Galloway et al., 2005; Moroshko & Brennan, 2013; Pelchat & Pliner, 1986; Webber et al., 2010). However, most data analysis methods used are correlations or regressions, providing little information with regards to causality. Further, cross-sectional studies, which constitute most of the literature reviewed here, limit the inferences one can make with regards to causality (Gregory et al., 2010), given the lack of follow-up data.

It is therefore just as likely that certain feeding strategies, such as pressure-to-eat or restriction, become employed in the face of the development of feeding problems in the child, such as fussiness or food refusal. This is shown by the bidirectional and circular arrows in Figure 2. Clearly, the presence of feeding problems in a young child can be distressing to caregivers (Greer et al., 2008) and an impairment to the child's ability to feed has been shown to heighten parental anxiety. This can in turn lead to stressful feeding situations eliciting negative feeding behaviours, such as pressuring the child to eat (Davies et al., 2006; Dovey et al., 2008).

In support of this, Carper (2000), Galloway (2005), Webber (2010) and Jansen (2012) and colleagues suggest that the association between feeding strategies and feeding problems is bidirectional and strategies can be employed as a response to the child's eating style, food intake or weight status. Similarly, Rigal and colleagues (2012) argue that feeding strategies emerge as responses to difficult-to-feed children, with authoritarian or permissive styles being the easiest way to cope with a child's resistance to feeding. It is interesting to consider this with regards to the later development of eating disorders. For example, Micali and colleagues (2007) found that low weight at six months predicted the development of AN in adulthood. This may be due to the effect of parental feeding strategies used in response to concerns over the low weight.

Given the difficulties in establishing a causal direction within the literature, it seems sensible to assume that the mother-child feeding dyad constitutes an interactive, bidirectional process, with feeding strategies acting as both potential causes in the development of a feeding problem but also maintaining factors, developed as a response to the child's behaviour. Should this be the case, the clinical implications of this literature are somewhat altered, as there are greater implications for the role of other factors in the development of feeding problems and later eating disorder, given that according to this theory, the problems may have in part existed prior to any parenting feeding strategy.

## **The Wider Context**

It appears from the literature reviewed that feeding problems can often be just one presenting problem and representation of a wider difficulty in the child's life. For example, three studies (Pelchat & Pliner, 1986; Lewinsohn et al., 2005; McDermott et al., 2010) found evidence for relationships between feeding problems and overall problem behaviours in the child, including struggles for control, externalising behaviour, social withdrawal, internalisation, toileting problems, anxiety, aggression and destructive behaviour.

One explanation of this would be that individual maternal feeding strategies used may be just one indication of a wider parenting style such as authoritarian or permissive parenting, as defined by Baumrind (1966). One could hypothesise that there would be more struggles for control within authoritarian parenting relationships, not only at mealtimes but in all aspects of the child's life. In support of this, Moroshko and Brennan (2012) highlight associations between overall authoritarian parenting and feeding problems. Similarly, lack of maternal warmth, higher aversiveness and struggle for control between mother and child have been linked to feeding difficulties (Chatoor et al., 1987; Lewinsohn et al., 2005; Sanders et al., 1993); arguably elements of authoritarian parenting. However, this association does not appear to continue into adulthood, with two studies here finding no relationship between parenting style and rates of adult eating difficulties (McDermott et al., 2010; Nicholls & Viner, 2009). This is

perhaps an illustration of the proposed idea that external factors become more influential in the later development of eating disorders.

Related to parenting style is the quality of the relationship between the mother and child. Indeed, it is argued by many researchers (e.g. Lucarelli et al., 2013) that the child's individual, specific feeding difficulties cannot be separated from the context of his wider environment and significant relationships. The feeding experience particularly is a unique interactive situation where the mutual exchange of communication creates a shared rhythm and mutual regulation; satisfying both child and parent needs and expectations (Sanders et al., 1993; Lucarelli et al., 2003). However, this process can become interrupted, for example when the infant's hunger and satiety signals are difficult to read, or when the parent is preoccupied with their own needs (Chatoor, 2002).

In support of the role of the mother-child relationship, Sanders and colleagues (1993) found a significantly higher level of aversive maternal behaviours, possibly indicating a poorer mother-child relationship, in a feeding-disordered group than a non-feeding-disordered group. Similarly, Chatoor and colleagues (1987) found lower levels of 'dyadic reciprocity' in a feeding-disordered group and higher levels of conflict, struggles for control and maternal non-contingency. McPhie and colleagues (2011) also found that both more dysfunctional interactions were associated with higher BMI (and potentially disinhibited eating) and less maternal warmth was associated with lower BMI (and

potentially restrained eating). Similarly, struggles for control between mother and child (and therefore less pleasant mealtimes and potentially a poorer mother-child relationship) was found to be associated with higher pickiness and food refusal (Lewinsohn et al., 2005). It is also important to note that Nicholls and Viner (2009) found an association between mother-child separations prior to five years of age and the later risk of developing AN.

Difficulties in feeding, the mother-child relationship and the wider parenting style could potentially be explained by maternal mental health problems. For example, depression, anxiety, distress and stress have all been associated with feeding dysfunction (Blissett et al., 2007; Coulthard & Harris, 2003; Greer et al., 2008; Martin et al., 2013). Within this review, more than one study found links between maternal mental health problems and feeding difficulties (McDermott et al., 2010; Nicholls & Viner, 2009; Lewinsohn et al., 2005). For example, McDermott and colleagues (2010) demonstrated independent correlates of picky eating in childhood to include maternal anxiety or depression, which are known to impact attachment relationships (Cummings & Davies, 1994) as mothers become less warm, more emotionally withdrawn, disengaged, less responsive, less stimulating for the child, more critical and more hostile (Tronick, 1989).

The concept of the wider context and mother-child relationship becomes particularly clinically significant when one considers that both Marchi and Cohen

(1990) and Kotler and colleagues (2001) found that mealtime conflict and unpleasant meals predicted later symptoms of eating disorders, including food avoidance. This raises the question of whether it is the feeding problems indicated by struggles for control that are associated with the eating disorder, or whether the struggles for control indicate wider problems within the child and family context, which would then change the focus of intervention.

### **Methodological Concerns**

In general, the studies are of good methodological quality with adequate sample sizes and robust study designs. External validity is limited, however, within those studies which recruit samples from health settings (e.g. Sanders et al., 1993; Rydell & Dahl, 2005) or have inadvertently included children with organic problems (e.g. Chatoor et al., 1987). It is also important to note that as per the intention of this review, all samples studies are of Western background, which limits generalisability of the conclusions drawn. Similarly, the majority of samples were Caucasian and with the exception of four studies (Marchi & Cohen, 1990; Pelchat & Pliner, 1986; Powell et al., 2011, Rigal et al., 2012), all were middle-class families, which also limits applicability of the findings. A final point regarding generalisability is that the majority of studies included the observation of only maternal feeding practices; the role of paternal feeding practices would need to be investigated in order to apply the same conclusions.



There are also methodological concerns with some of the data collection procedures. For example, with the exception of the observational studies, nearly all studies use self-report measures. People do not always describe their behaviour with accuracy (Ballinger et al., 2004), particularly retrospectively, and the data are subject to social desirability and recall biases. When relying on parental self-report, for example, it is possible that parents of children with a history of feeding problems will be more likely to notice eating problems in later life. Similarly, people with eating disorders and their parents may be more likely to look for feeding problems in earlier life, as a way of constructing meaning behind the development of their illness (Micali et al., 2007).

A more reliable way of collecting data is the use of questionnaires. Unfortunately, many different questionnaires were used in the literature here, of which many are investigating the same behaviour or construct. For example, four different measures were used to assess parental feeding practices, six different measures were used to measure child eating attitudes and behaviours and finally, four different psychometrics were used to measure the presence of an eating disorder.

A further issue is that many measures were created by the authors themselves (Kotler et al., 2001; Pelchat & Pliner, 1986; Lewinsohn et al., 2005; Micali et al., 2007; Rigal et al., 2012; Marchi & Cohen, 1990; McDermott et al., 2010; Rydell & Dahl, 2005; Gregory et al., 2010) and although some are drawn from

well-validated existing measures, they are not standardised, which has implications for their potential biases. This is not to say that these measures are unreliable or invalid; many authors (e.g. Rigal et al., 2012; Pelchat & Pliner, 1986) underwent rigorous validation procedures and computed good reliability and validity of their own measures. However, their presence limits the robustness of the comparisons made between the studies, as we cannot be sure that all studies are measuring the same constructs.

The choice of measures used is particularly important in longitudinal or follow-up studies, as when looking for changes over time, the responsiveness of a questionnaire to clinical and subjective changes is a crucial feature (Marks, 2004). For example, Fitzpatrick and colleagues (1992) found large between-questionnaire differences in the impression of improvement, stability and deterioration of conditions in longitudinal studies.

There are concerns around the varied use of the terms “picky eating”, “fussiness” and “neophobia”. It is generally hypothesised that these constitute the same psychological construct but the conceptualisation of this has not been consistent in previous research (Dovey et al., 2008). For example, studies have shown that the measurement of each component of picky eating, fussiness or neophobia do not always correlate (e.g. Dovey & Martin, 2012). Most importantly, Dovey (2010) argues that a ‘diagnosis’ of picky eating cannot sensibly be applied to a child until they have come to the end of the naturally-

occurring food neophobic phase (around 6 years). However, just under half of the studies reviewed here apply the terms “picky eating”, “fussiness” or “food neophobia” to children less than 6 years old.

## CONCLUSIONS AND RECOMMENDATIONS

Children with feeding problems are often at risk of consequences to their health, social interaction and emotional world including nutritional deficiency, inability to engage with social eating environments and family conflict (Budd et al., 1992; Galloway et al., 2005). It therefore seems essential to uncover the aetiology of feeding problems in order to develop preventative interventions that can be employed before the child reaches the point of physiological or psychological impairment.

Maternal feeding practices, at least within Western, middle-class families, appears to be an area which influences the maintenance and even development of feeding problems in children, which can continue into adulthood. It is hypothesised here that, rather than feeding practices linking directly to later eating disorder, they influence the child's stable problematic eating style, which, when given the 'right' external influences in later life, can potentially develop into eating disorder.

However, it also seems that the aetiology of feeding and eating disorders illustrates a complex interplay of biological, behavioural, environmental and social factors (Sanders et al., 1993). It seems that maternal feeding practices can be viewed as an indication of the wider mother-child relationship and family context. It is recommended, therefore, that interventions for feeding problems

are multi-faceted and consider both the wider context and the resultant feeding practices.

Unfortunately, some results reviewed here are conflicting and the individual constructs investigated vary between studies, limiting the comparability, generalisability and specificity of conclusions that can be drawn. Similarly, it is important to note that all samples studied here were of Western origin and mostly of middle-class background, which means that the conclusions drawn cannot be applied to other socio-economic or cultural groups. Indeed, we know that feeding practices vary greatly across different cultures and religions (Southall & Martin, 2010) and possibly socio-economic groups; this is an area where feeding practices may play a differing role in the development of feeding problems and eating disorder and would need to be investigated further.

Although some conclusions can be drawn, this review highlights the paucity of meaningful, longitudinal research investigating the course of early feeding problems and links between eating disorders and early feeding practices. Although eating disorder incidence rates have remained stable over the last few years, they are becoming increasingly prevalent amongst Western, young females (Smink et al., 2012) with AN being associated with the highest rate of mortality of all mental health disorders (Harris & Barraclough, 1998). Given the prevalence and suffering associated with both feeding problems and eating disorder, it appears remarkable that there is not more research helping to

elucidate aetiological factors. Further longitudinal research is needed to provide more support for the hypothesised model presented here and researchers must continue to build the evidence base if robust preventative interventions for feeding and eating disorders are to be developed.

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**EMPIRICAL PAPER**

**The relationships between eating psychopathology and distraction during eating**

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## **EMPIRICAL PAPER**

### **The relationships between eating psychopathology and distraction during eating**

#### **ABSTRACT**

Research has shown that a variety of internal and external factors have an influence on our eating behaviour, including distraction, social interaction, memory and attention and individual psychological characteristics. This becomes clinically significant when considering the role of eating behaviour of people with eating disorders and the influence these factors could have in this population. However, more robust evidence for the complex influence of these factors is necessary before conclusions can be applied to clinical populations.

The study reported here aimed to contribute to the inconclusive evidence base regarding investigations into eating psychopathology, distraction and the role of memory. Specifically, the study aimed to investigate whether different levels of eating psychopathology strengthen the well-evidenced effect of distraction on food intake and meal memory, as found in previous studies. A working model is also proposed by the author to explain the control of eating behaviour, with reference to existing attentional resources and limited cognitive capacity theories (Heatherton & Baumeister, 1991; Polivy & Herman, 1993; Ward & Mann, 2000; Herman & Polivy, 1984; Boon et al., 2002).

The study was a between-subjects design, with two conditions. Sixty female undergraduate students ate a fixed lunch either playing a distracting computer game or in the absence of any distraction. Food intake and measures of meal memory were taken, alongside measures of eating psychopathology, including dietary restraint, disinhibition, drive for thinness, body dissatisfaction and bulimia.

Distraction was found to be a significant predictor of food intake but in the opposite direction to expected, with participants eating less when distracted, and there were no significant predictors of participants' meal memory (vividness or accuracy). Eating psychopathologies significantly predicted food intake but their interactions with condition did not. Participants seemed to experience the distractor used differently in terms of cognitive loading, depending on their internal distractors, such as depression.

It is argued that these surprising results are due to the specific qualities of internal and external distractors as well as the threatening nature of the food offered. Further studies with higher power are recommended in order to explore distractor qualities and the role of eating psychopathologies further.

## INTRODUCTION

### **Internal and External Factors in Eating Behaviour**

Empirical literature and anecdotal evidence provide strong support for the effect of a multifaceted set of internal and external influences on eating behaviour. Physiological mechanisms of hunger and satiety (e.g. Hellström et al., 2004) and sensory stimulation from the foods served (Rolls et al., 1981, 2006, 2007) are the most intrinsic internal factors. However, research has shown that other, rather more complex factors may be at play, which can override these basic mechanisms. Herman and Polivy's (1984) 'boundary model' of eating behaviour supports this, saying that outside extreme conditions of food deprivation or surfeit, non-physiological factors are of major importance in the onset and termination of eating. The model describes a 'biological indifference' existing between the two boundaries starvation and over-satiation and argues that within this range, psychological rather than physiological factors have the most influence on eating behaviour.

One of these psychological factors for which evidence is building is memory. The role of memory in eating behaviour has been evidenced since the early investigations showing how people with amnesia would continue to eat full-sized meals up to three times, with no self-reported change in satiety (Hebben et al., 1985; Rozin et al., 1998). Since then, research has started to investigate the role of memory for recent eating as an important factor in determining meal

size, both at the time and at later eating episodes (Higgs, 2002; Higgs & Woodward, 2009; Higgs & Donohoe, 2011). It has been shown that reminding participants of their previous eating episodes (and thereby improving the quality of their memory) acts as an inhibitor on their current and later food intake (Polivy et al., 1986; Higgs, 2002; Higgs et al., 2008). Further, Brunstrom and colleagues (2012) have shown that levels of satiety are higher at a later episode if participants only perceive (but not actually experience) having eaten a larger meal earlier. These studies are consistent with the suggestion that information in memory does not only help to determine the onset and termination of meals (Rozin et al., 1998) but is also factored into decisions about future consumption (Higgs, 2008). (See Robinson et al., 2013 for a systematic review of the literature.)

It is becoming clearer that internal and external factors in eating behaviour do not function independently but instead act on our food intake within a complex interaction. Of particular interest is the interaction between the role of memory and external distractions. Research has found that external distractors, including television (Bellisle & Dalix, 2001; Bellisle et al., 2004; Stroebele & deCastro, 2006; Blass et al., 2006; Higgs & Woodward, 2006), audio stories (Bellisle & Dalix, 2001; Bellisle et al., 2004), computer games (Oldham-Cooper et al., 2011; Cessna et al., 2007) and music (Stroebele & deCastro, 2006) can produce disinhibiting effects on current and later food intake. The proposed explanation for this is the distribution of attention, with attentional resources being taken away from internal cues for hunger and satiety (Hetherington et al.,

2006; Stroebele & deCastro, 2006; Bellissimo et al., 2007; Brunstrom et al., 2012; Brunstrom & Mitchell, 2006). Higgs and others' research has considered how the distractors may also be drawing attentional resources away from the encoding process of the memory for the meal eaten (Higgs & Woodward, 2009).

We know that memory is dependent on attention at encoding, with attended items being better remembered than non-attended items (MacDonald & MacLeod, 1998; Vuilleumier et al., 2005), and dividing attentional resources interrupts memory formation (Chun & Turk-Browne, 2007). In eating behaviour, this is evidenced by research into the effect of distraction on lower self-reported memory vividness (Higgs & Woodward, 2009) and lower accuracy of meal recall (e.g. Moray et al., 2007; Oldham-Cooper et al., 2011). Further, using focussed attention or 'mindful eating', intended to improve the quality of the memory, has resulted in the opposite effect to that of distraction, with food intake decreasing both at the time (Bellisle & Dalix, 2001; Hetherington et al., 2006) and at later eating episodes (Higgs & Donohoe, 2011). Together, these findings point to an important role for memory in the regulation of meal size and appetite.

### **The Role of Individual Psychological Factors; Eating Psychopathology**

Research has investigated how individual, variable, psychological factors, such as eating psychopathology, influence everyday eating behaviour. Of particular interest is the potential strengthening effect of these factors on susceptibility to the influence of internal and external factors; most notably, restrained eating.

Restrained eating (Herman & Polivy, 1980), or dietary restraint (Herman & Mack, 1975), refers to the purposeful restriction of food intake to control one's image or prohibit weight gain. It entails self-regulation, monitoring and an overriding of both internal cues and the normal response to stimuli. As such, dietary restraint can be seen as a further internal, rather than external, distractor away from the physiological sensations of hunger and satiety.

It is argued that if there is cognitive loading from another source, for example an external distractor, then this self-monitoring process is inhibited and behaviour becomes disinhibited (Heatherton & Baumeister, 1991; Polivy & Herman, 1993). It would therefore seem plausible that restrained eaters may be particularly susceptible to the disinhibiting effect of distraction because of their constant monitoring of eating behaviour (Ward & Mann, 2000). Indeed, studies have shown that they perform worse than unrestrained eaters on standard cognitive tasks while they are asked to imagine their favourite food (Brunstrom & Witcomb, 2004; Green, Rogers, & Elliman, 1999).

There exists some significant empirical evidence for this greater susceptibility of restrained eaters to the disinhibiting effect of distraction (Herman & Polivy, 1980; Westenhoefer, 1991; Ward & Mann, 2000; Bellisle & Dalix, 2001; Boon et al., 2002; Brunstrom et al., 2005). However, other more recent studies have shown no such effect (e.g. Bellisle et al., 2009; Long et al., 2011). For example, Long and colleagues (2011) found a main effect of a distraction on food intake but no interaction effect with levels of eating psychopathology in a sub-clinical

student population. However, the authors hypothesised that this could have been due to methodological issues, such as a low range of eating psychopathology in the sample and the use of a relatively low-calorie meal.

### **A Model to Explain Eating Control**

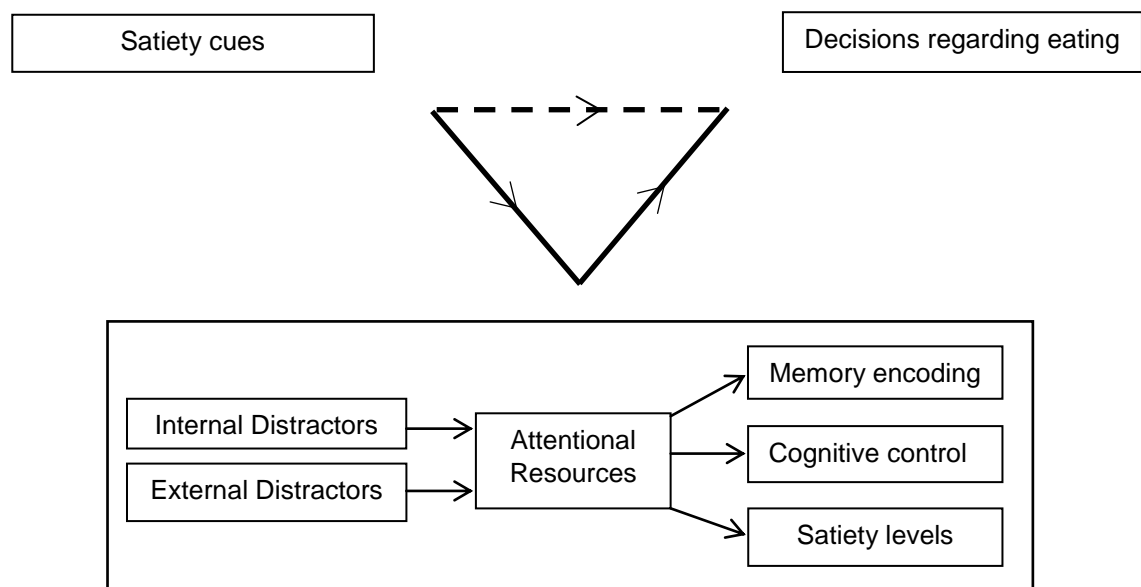
The distribution of attention hypothesis within restrained eaters is described as a need to focus on a “more urgent concern than even dieting” by Herman and Polivy (1984). Other researchers have explained this with the Limited Cognitive Capacity Hypothesis (Boon et al., 2002), whereby attentional resources are implicated by internal or external factors, meaning that fewer resources are available to focus on either the physiological sensations of hunger and satiety or the cognitive control over eating behaviour.

For a long time, strong negative and positive emotional states, such as anxiety, depressed mood or excitement, have also been well demonstrated in research to disinhibit eating among restrained eaters (Herman & Polivy, 1975; Baucom & Aiken, 1981; Frost et al., 1982; Ruderman, 1985; Cooper & Bowskill, 1986; Schotte et al., 1990; Cools et al., 1992; Polivy et al., 1994). These findings support the attention distribution model and point towards emotional states acting as internal distractors, drawing attentional resources away from hunger, satiety and the cognitive control of eating; thereby inhibiting the self-monitoring process.



In conclusion, it is proposed that our decisions regarding eating are not simply dependent on intrinsic hunger and satiety cues. Quality of memory for recent eating and the cognitive capacity we have to control our eating and attend to internal cues are also important and can be affected by internal and external distractors. A proposed model summarising this can be seen in Figure 1.

Figure 1



Proposed model of eating control

## Clinical Significance

Research into this area becomes more clinically relevant when considering interventions for those with eating pathologies and disorders. As discussed, evidence suggests that cognitive processes such as attending to food and encoding and retrieving memories of recently eaten foods play an important role in eating behaviour (Robinson et al., 2013). The findings indicate that avoiding

distraction and increasing awareness of food as it is eaten, alongside recalling previously eaten foods can help to reduce disinhibited eating (Higgs & Woodward, 2009; Higgs, 2002). This may be something to consider applying to the treatment of people with bulimia nervosa.

Alternatively, we can also hypothesise that increasing distraction, thereby reducing the awareness of food being eaten and inhibiting the quality of memory encoded, could be helpful when considering mealtime interventions for people with anorexia nervosa. Dietary restraint is often believed to precede the development of an eating disorder (Delinsky & Wilson, 2008) and disinhibition is often part of the presentation of people with bulimia nervosa (Rossiter, Wilson & Goldstein, 1989). For this reason, the relationships between different eating psychopathologies, such as restraint and disinhibition, and external factors moderating eating behaviour have clear clinical implications for people suffering from eating disorders.

### **Current Study (Rationale)**

Although much research has shown that individual psychological characteristics can increase vulnerability to the influences of internal and external factors in eating behaviour (Bellisle & Dalix, 2001), findings are limited in some areas, particularly with regards to eating psychopathologies, and are inconclusive at times (e.g. Bellisle et al., 2009; Long et al., 2011). Further, a hypothesis that has not yet been fully explored within this is the idea that the effect of distraction

is due to the induction of a negative affect as a result of having to perform two tasks simultaneously (e.g. frustration or anxiety). As we have seen, strong emotional states can lead to disinhibited eating in restrained eaters (Herman & Polivy, 1975; Baucom & Aiken, 1981; Frost et al., 1982; Ruderman, 1985; Cooper & Bowskill, 1986; Schotte et al., 1990; Cools et al., 1992; Polivy et al., 1994) and it may be that the effect of distraction is actually an illustration of the effect of emotional state. With the aim of investigating the effect of internal mood states, this study measures participants' immediate emotional state prior and following the meal, as well as a measure of more global emotional state.

With the exception of dietary restraint and to a lesser extent disinhibition, there exists very limited research (Long et al., 2011) into the effects of eating psychopathologies, such as drive for thinness, body dissatisfaction and bulimia. Further, the evidence for an effect of disinhibition is inconclusive, with Westenhoefer (1991) showing a more disinhibiting effect of distractors on those with high disinhibition but Bellisle and colleagues (2004) finding no difference. There is also very limited research (Long et al., 2011) into the interaction between eating psychopathology and quality of memory, looking at the ability to accurately estimate food consumed.

Although there is significant evidence for the role of memory in determining the onset and termination of meals (Rozin et al., 1998), the effect of distraction on disinhibited eating and the increased susceptibility of restrained eaters to this, if we are interested in applying these findings to clinical eating disorder

populations, there needs to be more conclusive investigation into the interaction between eating psychopathology, distraction and quality of memory.

### **Study Aims and Hypotheses**

The aim of the current study, therefore, is to investigate the effects of environmental distraction and cognitive loading on food intake and memory quality in those with varying levels of eating psychopathology. With regards to evidence for the effect of dietary restraint, this study aims to replicate previous findings, whilst adding more robust findings by addressing some of the methodological concerns raised by earlier studies. For example, recruiting a sample with a higher range of eating psychopathology, using a highly cognitive loading distractor, using a more robust memory measure and using a higher calorie meal. This study also aims to provide further evidence for the role of memory in eating behaviour and for any interaction between this and eating psychopathology.

Firstly, it is predicted that participants will eat more in the distraction condition, as in previous studies (e.g. Bellisle & Dalix, 2001; Boon et al., 2002; Bellisle et al., 2004; Stroebele & deCastro, 2006; Blass et al., 2006; Higgs & Woodward, 2009; Long et al., 2011). Secondly, it is predicted that participants' memory vividness and memory accuracy will be lower in the distraction condition (e.g. Higgs & Woodward, 2007; Moray et al., 2007).

It is then hypothesised that participants' levels of eating psychopathology will predict the amount eaten. Given the nature of the eating psychopathology, participants with higher levels of dietary restraint and drive for thinness are predicted to eat less and participants with higher levels of disinhibition and bulimia are predicted to eat more. The effect of participants' body dissatisfaction remains unknown and so the hypothesis remains two-tailed.

It is also predicted that participants' eating psychopathology will either strengthen or weaken the relationships between condition and food intake and condition and memory quality. In particular, it is hypothesised that a higher level of dietary restraint will predict higher food intake in the distraction condition (e.g. Ward & Mann, 2000; Bellisle & Dalix, 2001; Boon et al., 2002) and poorer memory quality (e.g. Long et al., 2011), particularly when distracted, based on the attention distribution model. With regards to emotional state, it is hypothesised that participants' level of positive and negative emotions will act as internal distractors and will strengthen the distraction effect on disinhibited eating.

## METHODS

### Participants

Participants were 65 female undergraduate students, with a mean age of 19.13 years ( $SD = .65$ ) recruited from the School of Psychology, University of Birmingham, taking part in the study in return for course credits. Exclusion criteria included smokers, non-English-speaking people, uncorrected hearing or visual impairments, food allergies, current medical treatment and a BMI outside of the 'normal' range (18.5-25.5). Five participants had to be excluded from the data set as their BMIs were above the 'normal' range. Therefore, the final data set included 60 participants, with a mean BMI of 21.31 ( $SD = 2.00$ ). An *a priori* power analysis was conducted for two-tailed multiple regression (with three main predictors; condition, eating psychopathology and their interaction), using an alpha level of .05, a power of .80 and Cohen's small effect size ( $d = .20$ ). This gave a minimum sample size of 59.

We did not exclude participants with a disclosed history of eating disorder, as we intended to recruit a wide range of eating psychopathology levels for this study. Previous literature (e.g. Long et al., 2011; Bellisle et al., 2004) suggests that the lack of association between eating psychopathology and food intake during distraction could be due to the sample's small range of eating psychopathology. Three measures of eating psychopathology (Drive for Thinness, Body Dissatisfaction and Bulimia) were measured using the Eating

Disorders Inventory (3<sup>rd</sup> edition) (EDI-3; Garner, 2004). The Three-Factor Eating Questionnaire (TFEQ; Stunkard & Messick, 1985) was used to measure participants' level of Cognitive Restraint of Eating and Disinhibited Eating. Levels of depression and anxiety were measured using the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). Participants' mean scores on the EDI-3 and HADS measures as well as clinical cut-off scores can be found in Table 1. Unfortunately, no clinical cut-off scores or norms exist for the TFEQ.

Table 1

Measure	Range	Mean score	SD	T score	Clinical cut-off score
EDI-3: Drive for Thinness (0-28)	23	7.4	6.54	24-38	≥ 57 ( <i>t</i> )
EDI-3: Body Dissatisfaction (0-40)	36	15.3	9.19	35-40	≥ 58 ( <i>t</i> )
EDI-3: Bulimia (0-32)	25	4.6	4.53	27-52	≥ 56 ( <i>t</i> )
TFEQ: Restraint (0-21)	20	7.2	5.40		
TFEQ: Disinhibited Eating (0-16)	14	7.7	3.33		
HADS: Anxiety (0-21)	13	7.1	3.36		≥ 8
HADS: Depression (0-21)	11	2.3	2.29		≥ 8

SD = standard deviation

Participants' scores on standardised measures

## Experimental Design

A between-subjects design was used in order to minimise the chance of revealing the study aims. There were two conditions: (1) a distraction group ( $n = 30$ ) and (2) a control group ( $n = 30$ ), to which participants were assigned on an alternating basis which continued across testing days. In Condition 1, participants were asked to eat their lunch whilst playing a computer game. In Condition 2, participants ate their lunch with no distractions. Between-subjects dependent variables comprised the amount of food eaten, participants' estimate of the amount of food eaten (memory accuracy) and self-rated vividness of their

memory of the meal. Possible between-subjects covariates were level of eating psychopathology and mood state, both current and global.

## **Research Materials**

### **i. Test food**

The lunch consumed by participants was the same in both conditions. Previous studies (e.g. Boon et al., 2002; Blass et al., 2006) have identified that higher calorie foods elicit a more significant effect on food intake during distraction in restrained eaters than do lower calorie foods. Further, Long and colleagues (2011) identified that a possible reason for the inconsistency in results in this area (e.g. Bellisle et al., 2009) could be the variety in calorific value of the foods offered. Therefore, a high calorie meal was used in this study which did not differ between participants or condition.

The meal consisted of nine miniature pizzas (Iceland Foods Ltd. U.K. CH5 2NW), including mozzarella and tomato, pepperoni and smoked ham flavours. Liking for all of these flavours was one of the inclusion criteria used in the study advertisement. A larger portion than would ordinarily consist a lunchtime meal was provided, to avoid ceiling effects, and contained approximately 695 calories. The nine pizzas were cut in half, providing 18 bite-size pieces in order to disguise portion size and reduce the likelihood that participants would keep count of the amount consumed. 350ml of water was also provided for each participant.



## ii. Distraction

The computer game participants were asked to play in Condition 1 is called the Helicopter Game (SeeThru.co.uk, 2004; accessed on [www.addictinggames.com](http://www.addictinggames.com)) and requires the use of one hand only and so the participant's second hand was free to eat the lunch. Participants were asked to achieve the highest score they could within the time given. In order to do this, it is assumed that a lot of the participants' attention is required. A high cognitive loading distraction was chosen as previous research (e.g. Ward & Mann, 2000) have shown that effects were more significant using a high cognitive loading distraction than a low cognitive loading distraction.

## iii. Measure of eating psychopathology

The EDI-3 (Garner, 2004) and the TFEQ (Stunkard & Messick, 1985) were used to assess the range of eating psychopathologies in participants. The EDI-3 contains 91 items divided into twelve subscales rated on a 0-4 point scoring system. For the purpose of this study, only those subscales of the EDI-3 measuring eating disorder symptoms were used (25 out of the original 91 items), producing scores for Drive for Thinness, Body Dissatisfaction and Bulimia. Participants responded to each item with one of the following: 'always', 'usually', 'often', 'sometimes', 'rarely' or 'never'. The EDI-3 has recently been shown to have excellent discriminant validity between all 12 subscales for both a clinical and non-clinical population (Clausen et al., 2011). Good reliability and

internal consistency has also been shown, with Drive for Thinness, Body Dissatisfaction and Bulimia having Cronbach's  $\alpha$  reliability coefficients between .87 and .93 ( $p < .01$ ) with a non-clinical population and .86 and .92 ( $p < .01$ ) in a clinical population (Clausen et al., 2011).

Two of the possible three subscales of the TFEQ were used (37 out of the original 51 items), giving scores for Cognitive Restraint of Eating and Disinhibited Eating. Participants responded with either 'true' or 'false' for the first 25 items and then along a Likert scale for the remaining 14 items. The TFEQ is suggested to be the most valid and reliable assessment of dietary restraint (Laessle et al., 1989), with Cronbach's  $\alpha$  reliability coefficients between .78-.94 for the three subscales (Cappelleri et al., 2009).

#### iv. Measure of mood

Participants' level of anxiety and depression was measured using the Hospital Anxiety & Depression Scale (HADS; Zigmond & Snaith, 1983). This is a fourteen-item scale (seven relating to anxiety, seven relating to depression), with each item being scored between 0 and 3. Bjelland and colleagues (2002) report a specificity of .78 for the anxiety subscale and a sensitivity of .9. For the depression subscale, a specificity of .79 and a sensitivity of .83 were found. The reliability and internal consistency of the HADS is also good, with Cronbach's alpha ranging from .68 to .93 for the anxiety subscale and between .67 and .90 for the depression subscale (Bjelland et al., 2002).

#### v. Portion estimation

A recent study (Higgs & Donohoe, 2011) used pictorial representations of portion size and asked participants to estimate the amount they had eaten. However, this was difficult to design in such a way that wasn't too easy to make an accurate estimation. Moray and colleagues (2007) asked participants to estimate on a visual analogue scale (between 1 and 10) the number of spoons of food they ate, after having been shown the amount represented by a spoon, which elicited significant results. Similarly, Long and colleagues (2011) asked participants to estimate how much they consumed as a percentage of the whole meal offered to them, which also elicited significant results. In this study, participants were asked to estimate their food intake as a percentage of the amount of food offered to them. Given the number of measures used in the study including an additional measure of memory vividness (below), it was felt that advantages gained by using more than one method of measuring portion estimation would be outweighed by the effects of participants' dwindling motivation and fatigue.

#### vi. Measure of memory vividness

A 100mm unipolar visual analogue scale (measured between 1 and 10) with endpoints anchored from 'not at all vivid' to 'extremely vivid' was used to assess participants' estimation of the vividness of their memory of the meal. Ratings were obtained by measuring the distance in millimetres from the left extremity of

the lines. The use of visual analogue scales as a psychometric measure has shown good test-retest reliability and validity (Flint et al., 2000) and offers good sensitivity (Joyce et al., 1975; Brunier & Graydon, 1996). Further, in eating behaviour research, it is widely accepted that carefully constructed unipolar visual analogue scales should be used when asking single-item questions (Blundell & Hill, 1988).

The portion size estimation measure also contributes to the assessment of participants' memory vividness, as this is compared to the actual food intake to give an over- or under-estimation.

#### vii. Additional measures

Further 100mm unipolar visual analogue scales (scored between 1 and 10), with endpoints anchored from 'not at all' to 'extremely' were administered before and after testing to assess participants' current mood levels and appetite ratings. The visual analogue scales measured the participants' subjective levels of hunger, fullness, desire to eat, happiness, sadness, stress, relaxation, and nervousness. Prior to data analysis, participants' self-rated levels of hunger, desire to eat and fullness were clustered to produce an average 'appetite' score. Similarly, self-rated levels of stress, anxiety and nervousness were clustered to produce an average 'anxiety' score.

Final 100mm unipolar visual analogue scales were administered to participants in Condition 1 following testing which measured the cognitive loading and distractibility of the computer game, asking participants to rate the level of complexity, interest, difficulty and stress during testing, as in Ward and Mann's study (2000). These four scores were later combined for *post hoc* data analysis, producing an overall "cognitive loading" score.

## **Procedure**

The sample comprised the first 60 volunteers who met the study's requirements. So that participants were not alerted to the purpose of the experiment, recruitment to the study was via an advertisement describing the experiment as a study of the effect of mood on taste preferences. Participants gave informed written consent (see Appendix 2) and the study protocol was approved by the Intramural Ethics Committee (see Appendix 6) and conducted according to the ethical standards laid down in the Declaration of Helsinki 1964.

Testing took place during appropriate lunchtime hours, between 11am and 3pm, with each testing slot occupying 1 hour. Upon arriving at the laboratory, each participant was given an information sheet to read about the study (see Appendix 1) and a consent form (see Appendix 2) to sign if they agreed to take part. The visual analogue scales measuring mood and appetite were then administered, along with the HADS questionnaire. The pizza meal was then

served; participants in Condition 1 were encouraged to try and get the best score they could on the game. Participants in both conditions were instructed to eat as much as they wanted; they did not need to finish the plate. They were then given 25 minutes to eat their lunch.

After this time, participants were given the second visual analogue scales measuring mood and appetite, followed by the EDI-3 and TFEQ questionnaires. The portion size estimation and memory vividness measures were included within the second set of visual analogue scales. Participants in Condition 1 were also given the visual analogue scales measuring the helicopter game's level of complexity, interest, difficulty and stress.

Finally, participants' height and weight were measured following testing, in order to measure their BMI. The amount of food consumed was measured by weighing the plate of pizza before and after testing, giving a measure of grammes eaten. Upon leaving, participants were given the contact details of appropriate sources of support (see Appendix 3), should they have felt distressed by the content of the questionnaires.

## **Data Analysis**

A one-sample Kolmogorov-Smirnov test was performed on independent and predictor variables (BMI, pre-lunch appetite, HADS scores and eating psychopathology scores) and an independent-samples Kolmogorov-Smirnov

test was performed to examine distribution across conditions. The data are presented in Table 2.

Table 2

	Independent-samples Sig. (2-tailed)	Z-value	Asymptotic Sig. (2-tailed)
BMI	.82	.72	.68
Appetite (0-10)	.07	.81	.53
HADS anxiety (0-20)	1.00	.92	.37
HADS depression (0-20)	.61	1.46	.03 *
TFEQ restraint (0-21)	.97	1.35	.05 *
TFEQ disinhibition (0-16)	.90	.75	.63
EDI-3 drive for thinness (0-28)	.90	1.02	.25
EDI-3 body dissatisfaction (0-40)	.93	.92	.37
EDI-3 bulimia (0-32)	.96	1.41	.04 *

Sig. = significance level

\*  $p < .05$

Kolmogorov-Smirnov test results on independent and predictor variables

The tests found that distribution of the data was not significantly different across conditions but that HADS depression, TFEQ restraint and EDI-3 bulimia scores were not normally distributed within the sample. As a result, both asymptotic significance levels as well as bootstrapped confidence intervals were used in regression analyses, as bootstrap confidence intervals do not require parametric assumptions.

Initial t-tests were conducted to identify differences between the control and distraction groups and differences prior to and following lunch, in order to verify the effect of the manipulations. Again, these tests were bootstrapped but biases produced were all smaller than .1 and so bootstrapped confidence intervals are

not reported. Correlations between variables of interest (eating psychopathology, mood and memory measures) were also run to give robustness to the validity of the measures used. Again, bootstrapping did not produce biases more than .1 and so bootstrapped confidence intervals are not reported.

EDI-3, TFEQ and HADS scores were centred to limit the influence of multicollinearity (see Appendix 5 for correlations) and interaction terms were computed for condition and eating psychopathologies. A hierarchical regression model was then employed to examine the contribution of condition, eating psychopathology and their interactions in determining food intake and memory quality. Participants' BMI and pre-lunch appetite were entered as control variables as these were both hypothesised to affect food intake. Participants' HADS scores were also entered as control variables, given their possible influence on food intake (e.g. Herman & Polivy, 1975; Cools et al., 1992).



## RESULTS

### Between-Group Characteristics

Table 3 shows independent-samples t-tests results, which revealed that participants did not significantly differ across conditions in terms of age, BMI, pre-lunch appetite, pre-lunch mood, HADS scores or eating psychopathology.

Table 3

	Condition	Mean	SD	T	Sig. (2-tailed)
Age (years)	Control	19.0	.54	-1.55	.13
	Distraction	19.3	.73		
BMI	Control	21.2	1.94	-.28	.12
	Distraction	21.4	2.10		
Appetite (0-10)	Control	6.59	1.67	-1.88	.07
	Distraction	7.31	1.29		
Happiness (0-10)	Control	6.20	1.53	.16	.87
	Distraction	6.14	1.56		
Sadness (0-10)	Control	1.85	1.65	-.60	.55
	Distraction	2.15	2.12		
Anxiety (0-10)	Control	2.77	1.42	.45	.66
	Distraction	2.58	1.87		
HADS anxiety (0-20)	Control	7.17	3.43	.27	.79
	Distraction	6.94	3.34		
HADS depression (0-20)	Control	2.00	2.35	-1.04	.30
	Distraction	2.61	2.23		
TFEQ restraint (0-21)	Control	7.38	5.36	.20	.84
	Distraction	7.10	5.52		
TFEQ disinhibition (0-16)	Control	7.38	3.19	-.76	.45
	Distraction	8.03	3.48		
EDI-3 drive for thinness (0-28)	Control	7.86	6.36	.58	.56
	Distraction	6.87	6.76		
EDI-3 body dissatisfaction (0-40)	Control	16.10	8.69	.66	.51
	Distraction	14.55	9.58		
EDI-3 bulimia (0-32)	Control	4.31	3.77	-.53	.60
	Distraction	4.94	5.18		

SD = standard deviation

Sig. = significance level

Participant characteristics

A paired-samples t-test revealed that all participants' appetite levels significantly reduced pre- and post-lunch, as expected ( $t(58) = 19.35, p < .01$ ). Participants' levels of happiness increased pre- and post-lunch ( $t(58) = -3.97, p < .01$ ) and levels of sadness decreased ( $t(58) = 3.52, p < .01$ ). Participants' anxiety levels also decreased pre- and post-lunch ( $t(58) = 4.59, p < .01$ ). An independent-samples t-test revealed that condition did not significantly affect participants' subjective change in appetite ( $t(58) = -.48, p = .64$ ), change in happiness ( $t(58) = 1.09, p = .28$ ), change in sadness ( $t(58) = -.35, p = .73$ ) or change in anxiety ( $t(58) = .27, p = .79$ ).

### **Effect of Condition on Food Intake and Food Memory**

Independent-samples t-tests revealed that there was no significant difference in percentage of meal eaten between the distraction condition ( $M = 61.8, SD = 22.78$ ) and control condition ( $M = 7.0, SD = 19.62$ );  $t(58) = 1.45, p = .15$ . There was also no significant difference in memory vividness between the distraction condition ( $M = 6.34, SD = 2.21$ ) and control condition ( $M = 6.93, SD = 1.51$ );  $t(58) = 1.20, p = .23$  or in memory accuracy (distraction  $M = 1.2, SD = 1.54$  control  $M = .7, SD = 9.90$ );  $t(58) = -.17, p = .87$ .

### **Effect of Eating Psychopathology on Food Intake and Food Memory**

Hierarchical multiple regressions were performed with participants' BMI, pre-lunch appetite and HADS scores as control variables, entered in step 1.

Condition was entered in step 2, eating psychopathology in step 3 and the interaction between eating psychopathology and condition in step 4.

i. Condition and eating psychopathology as predictors of food intake

In the final regression model, dietary restraint, condition and their interaction collectively accounted for 46% of the variance ( $R^2$ ). Condition alone added 6% of additional variance in step 2 ( $R^2$  change = .06;  $F(5,59) = 2.92$ ,  $p = .05$ ). Eating psychopathology added 19% additional variance in step 3 ( $R^2$  change = .19;  $F(10,59) = 3.28$ ,  $p = .02$ ). Adding the interactions between eating psychopathology and condition did not add a significant contribution to the variance ( $R^2$  change = .06;  $F(15,59) = 2.52$ ,  $p = .44$ ). See Table 4 for data.

Table 4

Table 1										
					Change Statistics					
Model	F	Sig.	R Square	Std. Error	R Square Change	F Change	df1	df2	Sig. of F Change	
1	2.51 (4,59)	.05	.15	2.49	.15	2.51	4.00	55.00	.05	
2	2.92 (5,59)	.02	.21	19.95	.06	4.00	1.00	54.00	.05	
3	3.28 (10, 59)	.00	.40	18.27	.19	3.09	5.00	49.00	.02	
4	2.52 (15, 59)	.01	.46	18.28	.06	.99	5.00	44.00	.44	

Sig. = significance level

Std. Error = standard error

df = degree of freedom

F and change statistics: predictors of food intake

In the final model, condition is the only significant individual predictor of food intake ( $t(56) = -2.50$ ,  $p = .04$ ). However, in step 3, disinhibition is a significant predictor of food intake ( $t(56) = 2.15$ ,  $p = .02$ ) and body dissatisfaction is nearing significance ( $t(56) = -1.74$ ,  $p = .08$ ). See Table 6 for data.

ii. Condition and eating psychopathology as predictors of memory vividness

In the final regression model, dietary restraint, condition and their interaction collectively accounted for 25% of the variance ( $R^2$ ). Neither condition nor eating psychopathology added significant contributions to the variance (Condition  $R^2$  change = .03;  $F(5,59) = 1.42$ ,  $p = .19$ . Eating psychopathology  $R^2$  change = .10;  $F(10,59) = 1.36$ ,  $p = .29$ ). Adding the interactions between eating psychopathology and condition added a further 3% of additional variance but this was also not a significant contribution ( $R^2$  change = .03;  $F(15,59) = .98$ ,  $p = .85$ ). See Table 5 for data.

Table 5

					Change Statistics				
Model	F	Sig.	R Square	Std. Error	R Square Change	F Change	df1	df2	Sig. of F Change
1	1.31 (4,59)	.28	.09	1.89	.09	1.31	4.00	55.00	.28
2	1.42 (5, 59)	.23	.12	1.88	.03	1.79	1.00	54.00	.19
3	1.36 (10, 59)	.23	.22	1.86	.10	1.27	5.00	49.00	.29
4	.98 (15, 59)	.49	.25	1.92	.03	.39	5.00	44.00	.85

Sig. = significance level

Std. Error = standard error

df = degree of freedom

F and change statistics: predictors of memory vividness

Table 6

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Bias	Std. Error	Sig. (2-tailed)	Bootstrapped 95% Confidence Intervals	
	B	Std. Error	Beta						Lower	Upper
1										
BMI	-1.92	1.38	-.18	-1.40	.17	-.07	1.37	.15	-4.45	.55
Appetite	4.54	1.84	.32	2.47*	.02	.04	1.90	.01	1.34	8.36
HADS Anxiety Score	.54	.93	.08	.58	.57	-.03	.87	.55	-1.13	2.13
HADS Depression Score	-1.77	1.32	-.19	-1.34	.18	.05	1.41	.18	-4.49	1.26
2										
BMI	-2.01	1.34	-.19	-1.49	.14	-.08	1.24	.11	-4.46	.22
Appetite	5.55	1.86	.39	2.99*	.00	.03	1.82	.00	2.28	9.48
HADS Anxiety Score	.23	.92	.04	.25	.81	.00	.82	.78	-1.27	1.79
HADS Depression Score	-1.24	1.31	-.13	-.94	.35	.04	1.32	.30	-3.69	1.62
Condition	-1.89	5.44	-.26	-2.00*	.05	.52	5.48	.05	-21.92	2.27
3										
BMI	-1.31	1.32	-.12	-.99	.33	.03	1.35	.31	-4.20	1.35
Appetite	4.18	1.85	.29	2.26*	.03	-.14	1.84	.03	.65	7.23
HADS Anxiety Score	.55	.91	.09	.60	.55	.07	.89	.54	-1.16	2.60
HADS Depression Score	-1.74	1.24	-.19	-1.41	.17	-.17	1.30	.15	-4.03	.21
Condition	-13.08	5.05	-.31	-2.59*	.01	.31	5.70	.03	-23.76	-1.02
Restraint	-.49	.70	-.12	-.70	.49	-.03	.77	.51	-2.08	.93
Disinhibition	2.27	1.06	.35	2.15*	.04	-.10	.90	.02	.56	3.73
Drive for thinness	-.46	.71	-.14	-.64	.52	.02	.85	.61	-1.99	1.19
Body dissatisfaction	-.69	.40	-.29	-1.74	.09	.00	.37	.08	-1.40	.00
Bulimia	.51	.85	.11	.60	.55	.17	1.09	.62	-1.82	3.38

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Bias	Std. Error	Sig. (2-tailed)	Bootstrapped 95% Confidence Intervals	
	B	Std. Error	Beta						Lower	Upper
4										
BMI	-1.17	1.41	-.11	-.83	.41	.07	1.45	.41	-4.23	1.90
Appetite	3.50	1.98	.25	1.77	.08	.00	2.18	.11	-.29	7.77
HADS Anxiety Score	.93	.96	.14	.97	.34	.10	1.22	.46	-1.48	3.77
HADS Depression Score	-2.44	1.33	-.26	-1.83	.07	-.12	1.71	.14	-5.50	.60
Condition	-12.76	5.11	-.30	-2.50*	.02	-.29	5.84	.04	-23.71	-2.22
Restraint	.03	.97	.01	.04	.97	.00	.94	.96	-1.91	2.05
Disinhibition	2.86	1.71	.44	1.67	.10	.08	1.55	.06	-.24	6.57
Drive for thinness	-1.37	.97	-.42	-1.42	.16	-.01	1.03	.15	-3.27	.86
Body dissatisfaction	-.65	.60	-.27	-1.08	.29	-.06	.56	.26	-1.62	.20
Bulimia	2.27	1.54	.48	1.48	.15	.07	1.50	.13	-1.45	5.19
RestraintxCondition	-.89	1.38	-.16	-.65	.52	-.19	1.93	.64	-4.22	2.32
DisinhibitionxCondition	-.81	2.28	-.09	-.36	.72	-.17	2.20	.68	-4.95	2.93
Drive for thinnessxCondition	1.55	1.43	.35	1.08	.29	.13	1.99	.40	-2.07	5.75
Body dissatisfactionxCondition	-.19	.80	-.06	-.23	.82	.08	.85	.82	-2.15	1.97
BulimioxCondition	-2.55	1.94	-.44	-1.32	.20	.09	2.53	.28	-7.76	2.91

Sig. = significance level

Std. Error = standard error

Predictors of food intake

### iii. Condition and eating psychopathology as predictors of memory accuracy

In the final regression model, dietary restraint, condition and their interaction collectively accounted for 19% of the variance ( $R^2$ ). Neither condition or eating psychopathology added significant contributions to the variance (condition  $R^2$  change = .01;  $F(5,59) = .39$ ,  $p = .65$ . Eating psychopathology  $R^2$  change = .06;  $F(10,59) = .53$ ,  $p = .64$ ). Adding the interactions between eating psychopathology and condition added a further 9% of additional variance but this was also not a significant contribution ( $R^2$  change = .09;  $F(15,59) = .70$ ,  $p = .42$ ). See Table 7 for data.

Table 7

Model	F	Sig.	R Square	Std. Error	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. of F Change
1	.45 (4,59)	.78	.03	1.35	.03	.45	4.00	55.00	.78
2	.39 (5, 59)	.85	.04	1.42	.00	.21	1.00	54.00	.65
3	.53 (10, 59)	.86	.10	1.58	.06	.69	5.00	49.00	.64
4	.70 (15, 59)	.77	.19	1.56	.09	1.02	5.00	44.00	.42

Sig. = significance level

Std. Error = standard error

df = degree of freedom

F and change statistics: predictors of memory accuracy

### Post Hoc Analysis

In this study, participants' subjective game scores of complexity, interest, stress and difficulty were considered indicators of level of cognitive loading provided by the game. Table 8 shows the descriptive statistics for the game scores. Unfortunately, the mean game scores show that the computer game was not experienced as complex, interesting, stressful or particularly difficult by the

participants, suggesting fairly low cognitive loading. However, the range of game scores given was high. To identify a potential cause of variation in the game scores, post hoc correlations between game scores, HADS scores and eating psychopathology were performed.

Table 8

	Minimum	Maximum	Mean	SD
Game's level of complexity (0-10)	.0	8.0	2.23	2.21
Game's level of interest (0-10)	.5	1.0	4.48	2.59
Game's level of difficulty (0-10)	1.2	8.7	5.85	1.93
Game's level of stress (0-10)	.0	7.6	3.47	2.66
Overall cognitive loading score (0-10)	1.2	5.9	4.01	1.37

SD = standard deviation

Game descriptive statistics

Game's overall cognitive loading score was significantly negatively correlated with participants' dietary restraint ( $R(29) = -.41, p = .02$ ) and nearing significance with drive for thinness ( $R(29) = -.33, p = .07$ ) scores. The overall cognitive loading score is also significantly positively correlated with HADS depression scores ( $R(29) = .35, p = .05$ ). See Appendix 5 for full data.



## **DISCUSSION & CONCLUSIONS**

This study had three main aims. Firstly, to replicate previous findings concerning the effects of distraction on food intake and meal memory. Secondly, to explore the effects of different eating psychopathologies on food intake and meal memory under distraction conditions, in order to confirm or disconfirm previous findings. Finally, to identify any evidence for the role of mood state in explaining previous findings regarding eating psychopathologies.

Against the first hypothesis, participants in this study did not eat more when distracted but in fact, ate significantly less. This is a surprising result, which has not been found in previous studies (e.g. Bellisle et al., 2004; 2009) and cannot be explained by any group differences in BMI, appetite, mood or eating psychopathology. Given the efforts (using appropriate participant exclusion criteria and a controlled laboratory environment) to maintain internal validity and reduce the likelihood of extraneous variables, it can be assumed that this surprising result could be down to the choice of distractor used.

As explained previously, other studies have used television (Bellisle & Dalix, 2001; Bellisle et al., 2004; Stroebele & deCastro, 2006; Blass et al., 2006; Higgs & Woodward, 2006), audio stories (Bellisle & Dalix, 2001; Bellisle et al., 2004), computer games (Oldham-Cooper et al., 2011; Cessna et al., 2007) and music (Stroebele & deCastro, 2006); all with significantly higher food intake in the distraction condition. The game used in this study requires the participant's full

attention and the use of one hand throughout the duration; by the nature of the game, it requires constant attention and if the participant's eyes were to stray from the screen, they would lose the game. It may be that the high level of attentional resources required for this task renders it impossible to eat and play simultaneously, which would explain the lower intake in the distraction group. However, should this be the case, it would be expected that participants' satiety ratings would be different between conditions, which they are not, as the model presented earlier predicts that attentional resources are necessary to identify accurate satiety levels.

No significant effect of condition was found on participants' meal memory; either vividness or accuracy, in contrast with previous studies (Higgs & Woodward, 2009; Moray et al., 2007; Oldham-Cooper et al., 2011). This could be due to the measures used. Historically, there have been difficulties identifying measures of memory in this way and the visual analogue scales used in this study may not have been directly testing participants' memory of the meal. For example, when the question asks "how vivid is your memory of the meal?", participants could have interpreted this as the entire meal experience, which would include the experience of playing the game. As a result, vividness would be rated as highly in the distraction condition as in the control condition. It is also important to consider previous findings that the effect of distraction on memory is evident at later eating episodes (Higgs, 2002; Higgs & Woodward, 2009; Higgs & Donohoe, 2011). It is possible that the distraction effect does not act on

participants' memory at the time of eating (i.e. encoding), but would have an effect on a later eating episode if it were measured in this study (i.e. recall).

With regards to participants' eating psychopathology, although eating psychopathology added nearly twenty per cent of the variance in food intake, disinhibition was the only significant individual predictor of food intake in this sample. Therefore, disinhibition was the only eating psychopathology which added unique predictive value to the amount eaten, when condition was controlled for. This implies that level of disinhibition has more of an effect on food intake than any other level of eating psychopathology. However, given the limited evidence in the field thus far, this requires further investigation.

There were no significant relationships between eating psychopathology and differences in intake or meal memory between distraction and control conditions. This is in line with Long (2011) and Bellisle (2009) and colleagues' studies, who also found no effect of eating psychopathology. However, it is in contrast with other studies who found significant effects of dietary restraint in inducing disinhibited eating under distraction conditions (Herman & Polivy, 1980; Westenhoefer, 1991; Ward & Mann, 2000; Bellisle & Dalix, 2001; Boon et al., 2002; Brunstrom & Mitchell, 2005).

In particular, Brunstrom and colleagues (2005) found that participants with high dietary restraint ate more when distracted than participants with low restraint. However, the distractor used was a Rapid Visual Information Processing Task,

which provides a tangible measure of sustained attention; something that the distractor in this study did not. Further, they did not provide a lunch meal as such; more snack-type foods. Their study also split the eating psychopathology according to the median, giving high and low scores and thereby creating artificial groups. BMI was also not recorded. There are, therefore, methodological differences between this study and that of Brunstrom and colleagues (2005), which could explain the different results found.

An important consideration is also the eating psychopathology measures used. The three most commonly used measures, The Restraint Scale (Herman & Polivy, 1980), The Three Factor Eating Questionnaire (Stunkard & Messick, 1985) and the Dutch Eating Behaviour Questionnaire (van Strien et al., 1986) all measure dietary restraint in different ways. For example, The Restraint Scale measures chronic dieting, the DEBQ investigates weight loss behaviours and the TFEQ includes an assessment of the importance of thinness and body image. As such, it is likely that differences between study findings may be due to differences in the measures of dietary restraint used (Dovey, 2010).

Brunstrom and colleagues (2005) found that when manipulating the perceived 'threat' of the food offered (i.e. offering forbidden food), food intake was not higher in the highly restrained participants. They hypothesised that this effect was due to greater attentional resources being focussed on dietary control than when the food is less threatening. It is possible that the pizza offered in this

study constituted a threatening, forbidden food, requiring more effort in dietary control, which is why we do not see a disinhibiting effect of the distraction.

This is potentially supported by the post hoc finding that participants with lower dietary restraint found the game more cognitively loading. Given the threatening nature of the food offered, participants higher in dietary restraint potentially had fewer attentional resources being available for the game and therefore gave lower self-reported scores of cognitive loading (i.e. difficulty, interest, complexity and stress) because they were not attending to it. However, the second post hoc finding that cognitive loading scores were higher in participants with higher depression scores implies that when attentional resources are taken up by something else (i.e. depression), other stimuli are actually perceived as high cognitively loading, rather than low; this is in contrast with the interpretation of the correlation between dietary restraint and cognitive loading.

This is perhaps explained by different forms of cognitive loading produced by dietary restraint and depression; restraint requiring much more intentional cognitive effort than depression. It is conceivable that when internal distractors require higher levels of cognitive effort (e.g. dietary restraint), the cognitive loading of alternative stimuli is experienced as much less, as participants are not intentionally attending to them. On the other hand, when the internal distractors require less cognitive effort (e.g. depression), alternative stimuli are perceived as higher cognitive loading, as participants are intentionally attending to them, albeit hampered by their depression.

To determine this, it would have been interesting to have recorded participants' game scores; should the interpretation be correct, it can be predicted that high levels of dietary restraint would predict lower game scores, as participants' attentional resources would be focussed on cognitively controlling their eating of the forbidden food, rather than playing the game. With higher levels of depression, however, one could expect to see higher game scores, despite higher levels of cognitive loading, as participants are actively attending to the game.

There was no significant difference in subjective mood states between distraction and control conditions, meaning that the significant difference in food intake cannot be explained by differences in mood induced by the game; thus, mood was not acting as an internal distractor in this study. A final hypothesis was that an effect of eating psychopathology on susceptibility to distraction could be due to the distractor's impact on mood of those with higher eating psychopathology scores. However, given that there was no effect of eating psychopathology seen in this study, this would need to be explored further in future replication work.

### **Strengths, Limitations and Recommendations for Future Work**

This study has the advantage of a larger sample size than other studies in the field. It has also rectified certain methodological concerns raised by previous studies in the field, including using a high calorie food, as recommended by

Long and colleagues (2011) and a non-food-related distractor as recommended by Higgs and colleagues (2009; 2011).

The sample constitutes a good range of eating psychopathology levels (see Appendix 5 for data) where previous studies have been limited by a small range (e.g. Bellisle et al., 2004). Further, measures of both psychological components of eating disorders (drive for thinness, body dissatisfaction and bulimia) and behavioural characteristics (dietary restraint and disinhibition) are included, where previous studies (e.g. Long et al., 2011; Bellisle et al., 2004; 2009) have been limited by one or the other. However, there are also limitations which need to be borne in mind when interpreting the results.

With regards to the data analysis, post hoc power analyses found that the multiple regression analysis for food intake had excellent power (.99). However, the analyses for memory vividness and memory accuracy had inadequate statistical power (.69 and .51 respectively). Therefore, results from these analyses must be interpreted with caution and need replication with a larger sample in order to produce more powerful results. Similarly, given the small sample size ( $n = 31$ ), the power of the post hoc correlations with game cognitive loading score was inadequate (ranging between .05 and .64) and so must be interpreted with caution.

It is important to consider that the study took place in a laboratory setting. As with any laboratory study, there are problems with using an artificial setting

(Wasink & Sobal, 2007) but in itself, this may have been distracting to participants. Further, eating within a laboratory environment is not representative of a natural eating episode (Dovey, 2010), particularly when the participant is eating alone without any forms of distraction. One consideration within this is that the range of time where testing took place is fairly significant (from 11am to 2pm), which may not be representative of when the population would normally eat their lunch. Similarly, although participants were instructed not to eat for 2 hours prior to testing, this could not be verified at the time of testing. This, as well as the time of testing, may explain participants' appetite levels upon arrival, which were not significantly elevated ( $M = 7$  out of 10).

The meal offered is an important consideration in studies investigating food intake. As explained earlier, the miniature pizzas in this study were chosen because of their higher calorie content and relatively easy opportunity for disguising portion size. However, as well as the impact of the threatening nature of the food, it may be that participants were able to monitor the amount of pizza they were consuming, despite our efforts, by counting the number of pizza halves they ate. It may be more effective in future studies if a meal were used, as in Bellisle and colleagues' studies (2001; 2009; 2004), rather than a form of 'finger food'. However, this clearly then has implications for the nature of the distractor that can be used.

As explained earlier, it is possible that the choice of game used in this study did not provide the appropriate level of cognitive loading. Future studies could use



multiple conditions, with different distractors in each. It may be helpful, for example, to compare different types of computer games; including ones which do not require constant attention, as with the helicopter game used here. Another consideration for future work may be to include a separate focussed attention condition, as in previous studies (e.g. Long et al., 2011). This would allow for clearer comparison of the effect of distraction.

It may also be pertinent to use a more specific measure of memory. For example, if visual analogue scales are used to estimate vividness, then it needs to be clear that the vividness refers to the food experience and not the overall experience. Portion estimation has been used in previous studies (e.g. Long et al., 2011) as one way of measuring participants' memory. A previous study (Higgs & Donohoe, 2011) also used photographs for participants to identify portion size, but this also had limitations. Perhaps future studies could use a number of different memory measures, in order to produce a more robust overall memory measure.

## **Conclusions and Clinical Implications**

Given the lack of a disinhibiting effect of distraction, it is impossible to draw conclusions regarding the added impact of eating psychopathology in this sample. The lack of this main effect, however, can be used as support for an attentional resources model if it is interpreted as a consequence of the distractor's qualities. This study cannot prove or disprove the process whereby

distractors result in fewer attentional resources available to focus on cognitive control of eating. However, if the game was so highly distracting and required such high attention from participants that they could not allocate attentional resources to eating at all, this can be interpreted as evidence for an attentional resources model in general.

This work contributes to the existing inconclusive evidence base regarding the complex interactions between distraction, eating psychopathology and memory. It has extended the evidence base by investigating a number of different eating psychopathologies, where only dietary restraint has been the focus of most previous studies. From this study alone, it would appear that high levels of eating psychopathology do not render people more susceptible to the effects of distraction, at least in a sample of female, undergraduates within a 'normal' BMI range. Previous work has been fairly firm in the conclusion that avoiding distraction and increasing awareness of food as it is eaten, alongside recalling previously eaten foods can help to decrease food intake (e.g. Higgs & Woodward, 2009; Higgs, 2002). However, this study shows that the specific qualities of distractors, both internal and external, may be important in determining the effect of distraction, at least in this sample.

Understanding the decision-making processes underlying food intake is important and given the clinical relevance of this field to people with eating disorders, this study is an important addition to the evidence base. If it is the case that only certain distractions will increase intake, any mealtime

interventions for people with eating disorders will need to be carefully considered. As is the case in this study, should distractors be used which are too highly cognitively demanding, the outcome may indeed be the opposite to that intended (i.e. to promote food intake in anorexic patients). It is also likely that the majority of foods will be perceived as forbidden by people with eating disorders, which has implications regarding the allocation of attentional resources; less to the distraction and more to the dietary control. Having said this, there are potential positive clinical implications for people with a tendency to over-eat, such as those with bulimia nervosa. Perhaps with this population, a distractor such as the one used in this study would be helpful in reducing the amount of over-eating.

However, there are clear limitations to the interpretations of this study and replication is highly recommended before any firm conclusions can be drawn or applied to a wider sample in the population. Given the potential clinical applications to people with eating disorders, it is staunchly important to generate a large evidence base and it is recommended that future work focus on individual qualities of internal and external distractors as well as further exploration of the role of eating psychopathology in these complex interactions.

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**EXECUTIVE SUMMARY: PUBLIC DOMAIN BRIEFING DOCUMENT**

**Eating Pathology: Links to Childhood Feeding and Interaction with  
Mealtime Environment**

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## **EXECUTIVE SUMMARY: PUBLIC DOKAN BRIEFING DOCUMENT**

### **Literature Review: The role of feeding practices in the development of non-organic feeding disorder and later eating disorder**

Children with feeding problems are often at risk of consequences to their health, social interaction and emotional world (Budd et al., 1992; Galloway et al., 2005). Research has shown that maternal feeding practices are often associated with feeding difficulties and although childhood feeding problems and later eating disorders are often equated in the literature (Southall & Martin, 2010), links between maternal feeding practices and later eating disorders are not explicit. A literature review was therefore conducted to investigate links between feeding difficulties and later eating disorder and to consider how maternal feeding practices may contribute to this.

Findings suggest that maternal feeding practices significantly contribute to the incidence of child feeding problems, with authoritarian, controlling feeding practices being associated with higher levels of feeding problems such as fussiness. The associations between feeding practices and feeding difficulties is not clearly uni-directional and it is hypothesised that feeding practices could also be a response to the feeding difficulties, rather than the other way around. It is also proposed that feeding practices and the feeding episode between a mother and child is an indication of the context of their wider relationship, which may be the underlying important factor in the development of feeding difficulties.

A model is proposed to explain how feeding practices, as part of the wider relationship context, can influence the development of a child's eating style, which can progress into an eating disorder given the correct external factors in later life. However, further research is needed into the longitudinal relationships between feeding practices and eating disorder, before more robust conclusions can be drawn and these findings can be applied in clinical settings.

### **Empirical Paper: The relationships between eating psychopathology and distraction during eating**

*Background:* There are a number of internal and external factors that affect our eating behaviour as well as basic feelings of hunger and fullness. Research is growing into the role of memory in the control of eating, with studies showing increased food intake when memories of recent eating is impaired (Higgs, 2002; Higgs & Woodward, 2009; Higgs & Donohoe, 2011). This is used to explain the effect of increased food intake when we are distracted; our memories do not encode correctly because our attention is taken away. Some recent studies have shown that people with higher levels of eating disorder cognitions are particularly vulnerable to this effect, but results are limited and inconclusive thus far. Therefore, a study of the interaction between eating disorder cognitions and distractions during eating was carried out.

*Method:* The study was carried out in an eating behaviour university laboratory. Sixty female, undergraduate students were allocated to one of two groups, one of which ate lunch with a computer game distraction and one without.

Participants' food intake was measured and questionnaires were used to identify their level of eating disorder cognitions and memory of their lunch.

*Main findings:* Distraction was found to be a significant predictor of food intake but in the opposite direction to expected; distracted participants ate less. There were no significant predictors of participants' meal memory (vividness or accuracy). Eating disorder cognitions significantly predicted food intake, as expected, but they had no more or less effect depending on the condition. It appeared that participants experienced the distraction differently, depending on their internal distractors.

*Conclusions:* It is argued that these surprising results are due to the specific qualities of internal (for example, mood) and external distractors as well as the perceived threatening nature of the food offered (i.e. calorific). There are some limitations to the study because of the laboratory setting, specific measures used and power of some of the statistical analyses. This study contributes to the limited evidence base for the complex interactions between eating, distraction, memory and eating disorder cognitions. However, further studies with higher power are recommended in order to explore distractor qualities and the role of eating disorder cognitions further, before any firmer conclusions can be drawn.

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## APPENDICES FOR LITERATURE REVIEW

### Appendix 1: List of studies selected for review

1. Carper, J., Fisher, J., Birch, L.L. (2000). Young girls' emerging dietary restraint and disinhibition are related to parental control in child feeding. *Appetite*, 35, 121–9
2. Chatoor, I., Egan, J., Geston, P., Menveille, E., & O'Donnell, R. (1987). Mother–infant interactions in infantile anorexia nervosa. *Journal of the American Academy of Child and Adolescent Psychiatry*, 27, 535–540.
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4. Galloway, A.T., Lee, Y., & Birch, L.L. (2005). Parental pressure, dietary patterns and weight status among girls who are 'picky eaters'. *Journal of the American Dietetic Association*, 105 (4), 541-548.
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10. Matton, A., Goossens, L., Braet, C., & Van Durme, K. (2013). Continuity in primary school children's eating problems and the influence of parental feeding strategies. *Journal of Youth & Adolescence*, 42, 52-66.
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13. Micali, N., Holliday, J., Karwautz, A., Haidvogel, M., Wagner, G., Fernandez-Aranda, F., Badia, A...Treasure, J.L. (2007). Childhood eating and weight in eating disorders: A multi-centre European study of affected women and their unaffected sisters. *Psychotherapy and Psychosomatics*, 76, 234-241.
14. Moroshko, I., & Brennan, L. (2013). Maternal controlling feeding behaviours and child eating in preschool-aged children. *Nutrition & Dietetics*, 70, 49-53.
15. Nicholls, D.E., & Viner, R.M. (2009). Childhood risk factors for lifetime Anorexia Nervosa by age 30 years in a national birth cohort. *Journal of the American Academy of Child and Adolescent Psychiatry*, 48 (8), 791-799.
16. Pelchat, M. L., & Pliner, P. (1986). Antecedents and correlates of feeding problems in young children. *Journal of Nutrition Education*, 18, 23-29
17. Powell, F.C., Farrow, C.V., & Meyer, C. (2011). Food avoidance in children: The influence of maternal feeding practices and behaviours. *Appetite*, 57 (3), 683-693.
18. Rigal, N., Chabanet, C., Issanchou, S., & Monnery-Patris, S. (2012). Links between maternal feeding practices and children's eating difficulties: Validation of French tools. *Appetite*, 58, 629-637.
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## **Appendix 2: Key for data extraction table**

AN: Anorexia Nervosa

BN: Bulimia Nervosa

BDI: Beck Depression Inventory (Beck et al., 1961)

CBCL: Child Behavior Checklist (Achenbach, 1992)

CEBQ: Children's Eating Behavior Questionnaire (Wardle et al., 2001)

ChEAT: Swedish version of the Children's Eating Attitudes Test (Garner & Garfinkel, 1979)

ChEDE-Q: Dutch version of the Children's Eating Disorder Examination (Decaluwé, 1999)

CFNS: Children's Food Neophobia Scale (Pliner, 1994)

CFSQ: Caregivers Feeding Style Questionnaire (Hughes et al., 2005)

CFQ: Child Feeding Questionnaire (Birch et al., 2001)

CFPQ: Comprehensive Feeding Practices Questionnaire (Musher-Eizenman & Holub, 2007)

DAS: Dyadic Adjustment Scale (Spanier, 1976)

DISC: Diagnostic Interview Schedule for Children (Costello et al., 1985)

DEBQ: Dutch Eating Behavior Questionnaire (Van Strien et al., 1986)

DSSI: Delusional Symptom Status Inventory (Bedford & Foulds, 1977)

EAS: EAS Temperament Survey for Children (Buss & Plomin, 1984)

EATATE: EATATE Phenotype Interview: Part 1 (constructed from the Longitudinal Interval Follow-up Evaluation (Keller et al., 1987) and the Eating Disorders Examination (Fairburn & Cooper, 1993)

ED: Eating disorders

FFQ: Food Frequency Questionnaire (Kristal et al., 1997)

FNS: Food Neophobia Scale (Pliner & Hobden, 1992)

FPs: feeding practices

KCFQ: Children's version of the Child Feeding Questionnaire (Carper et al., 2000)

MOS: Mealtime Observation Schedule (Sanders & Le Gris, 1989)

ORI-CEBI: Oregon Research Institute Child Eating Behavior Inventory (Lewinsohn et al., 2005)

PSI-PCDI: Parent-Child Dysfunctional Interaction subscale of the Parenting Stress Index (Loyd & Abidin, 1985)

PSQ: Parenting Style Questionnaire (Robinson et al., 1995)

PSSI: Perceived Social Support Inventory (Procidano & Heller, 1983)

RA: research assistant

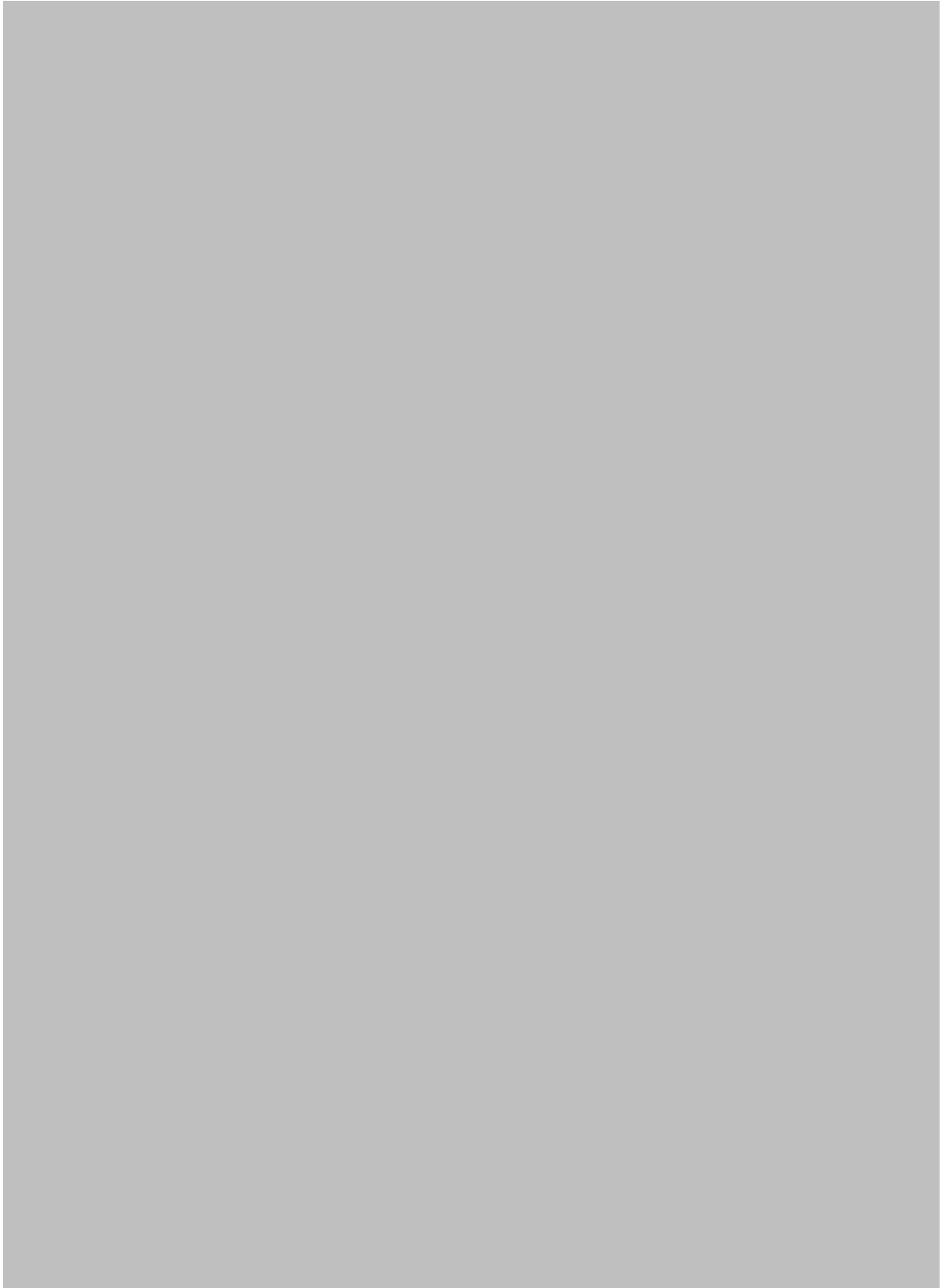
SCID: Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders-IV Axis I Disorders (First et al., 1997)

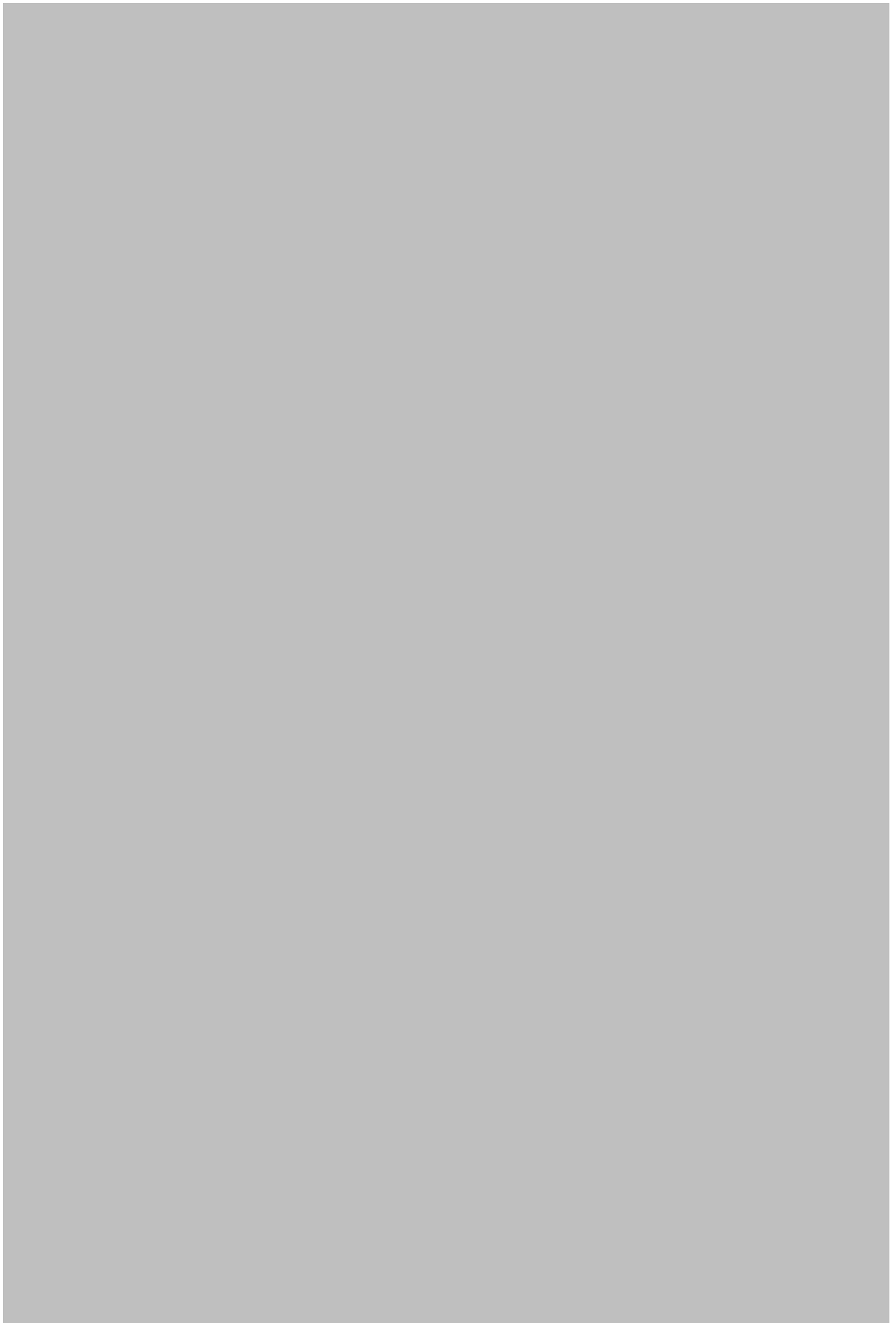
SES: socio-economic status

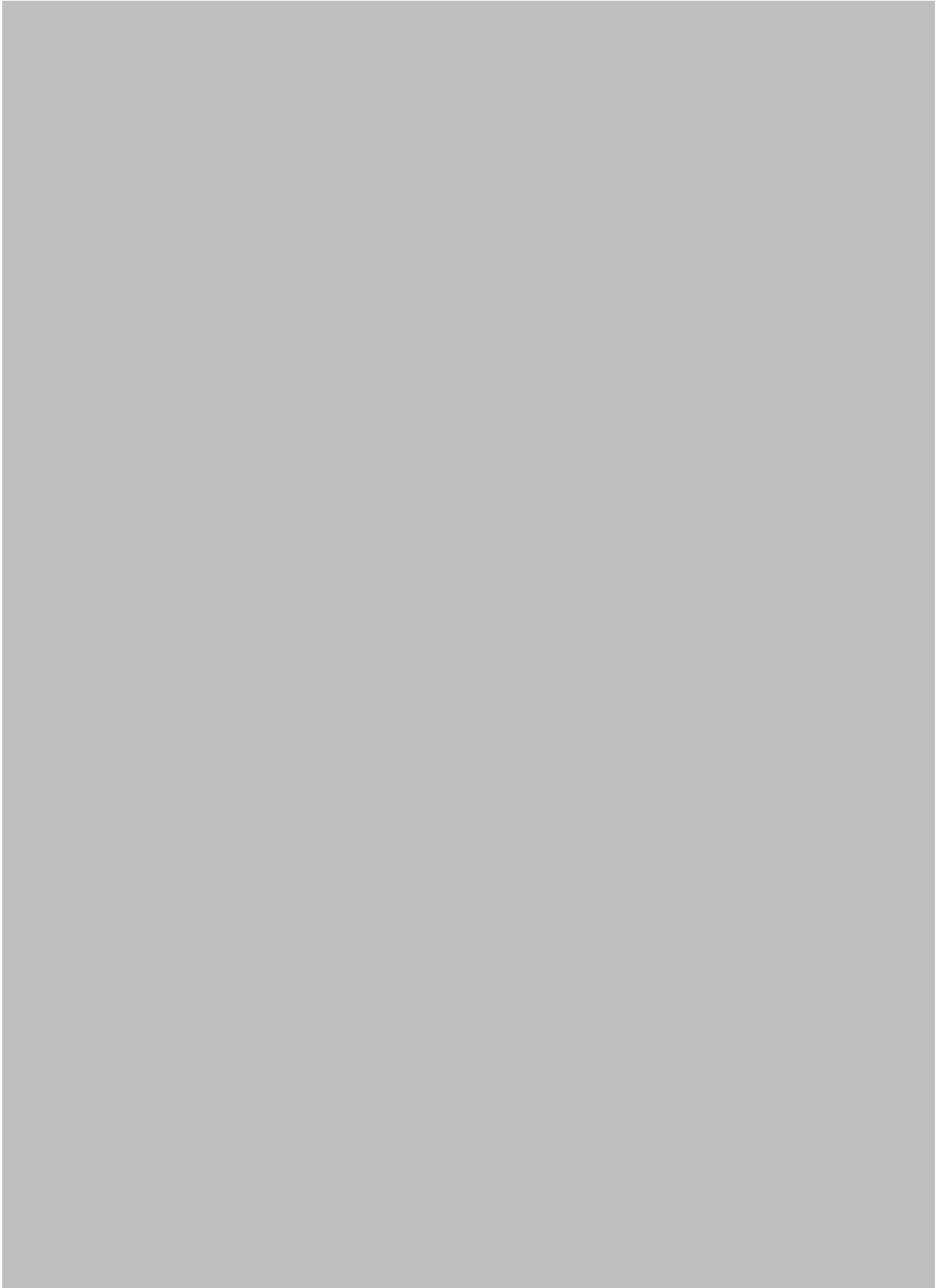
SIAB: Structured Interview for Anorexia Nervosa and Bulimic Syndromes (Fichter et al., 1998)

Vineland ABS: Vineland Adaptive Behaviour Scales (Sparrow et al., 1984)

### **Appendix 3: Critical appraisal tool (Fox & Joughin, 2002)**

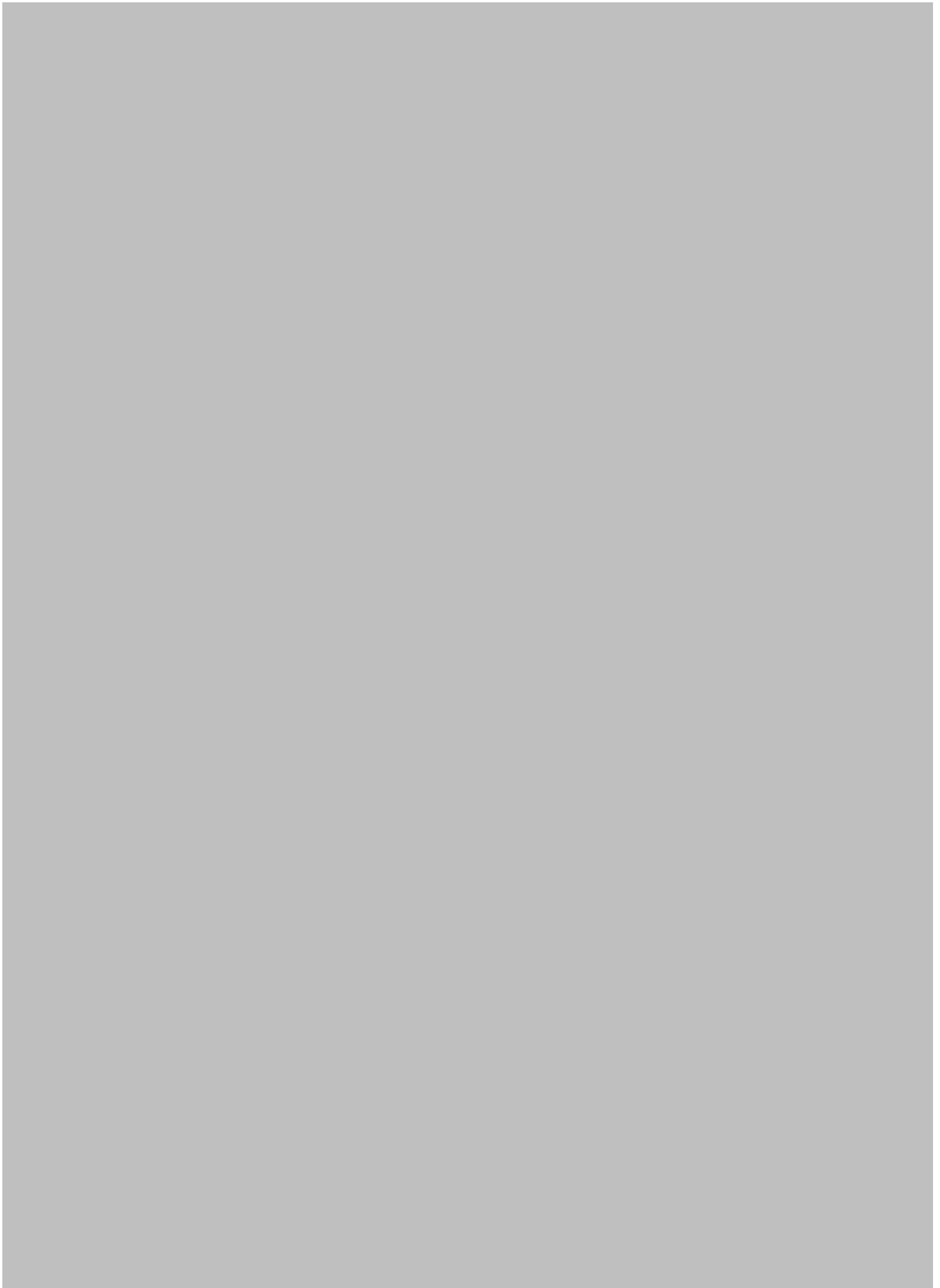




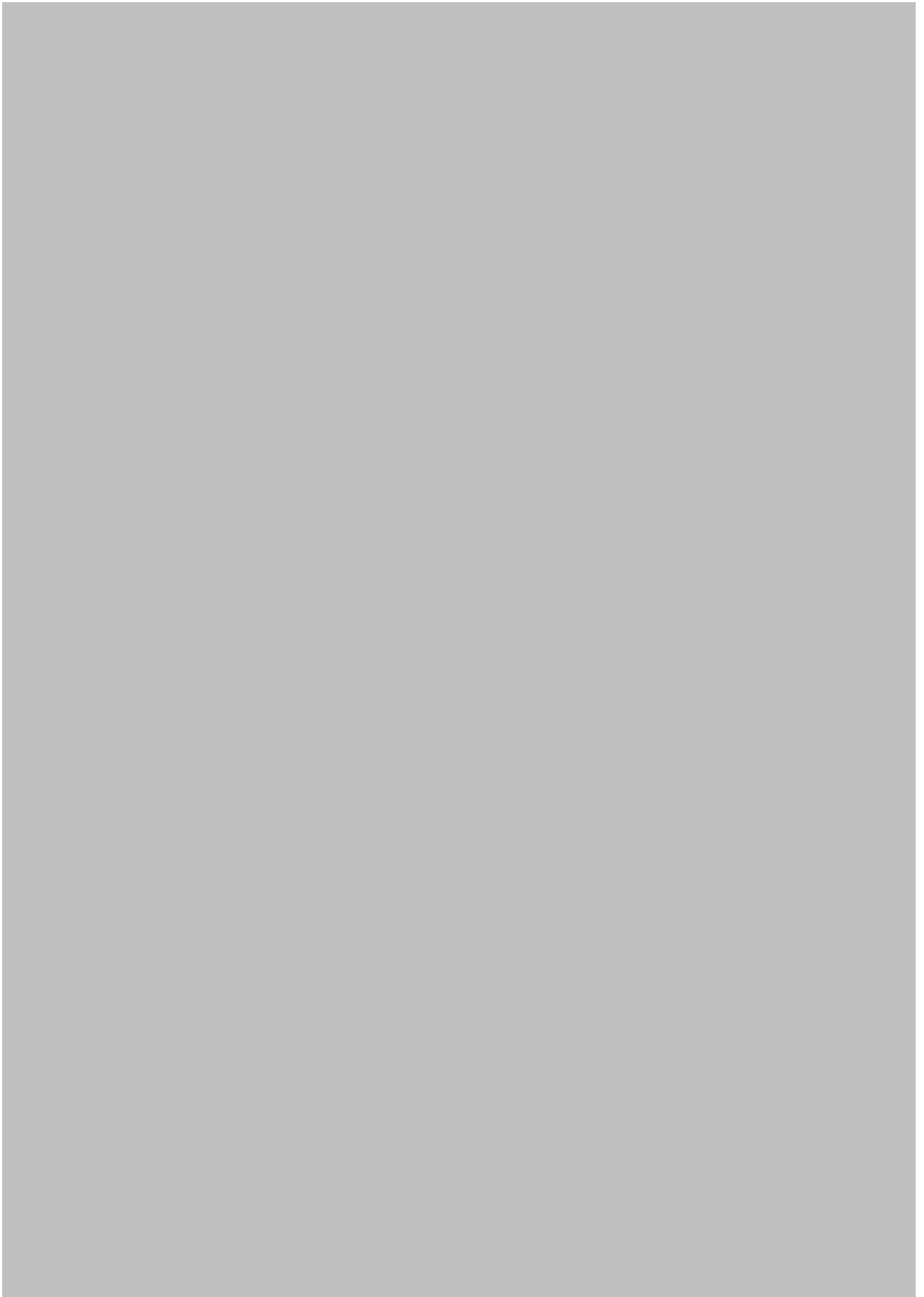




#### **Appendix 4: Critical appraisal tool (Caldwell et al., 2005)**









## **APPENDICES FOR EMPIRICAL PAPER**

### **Appendix 1: Participant information sheet**

#### **What is the study about?**

The aim of the study is to investigate the effect of mood on taste preferences.

#### **Who is taking part?**

Participants are undergraduate female students from the University of Birmingham. Individuals with certain food allergies or a vegetarian diet cannot take part in this study. If you have a food allergy you must inform the researcher now.

#### **What will I have to do?**

First of all you will be given a questionnaire about your mood, background and eating lifestyle. Then you will be given some lunch to eat, followed by 4 questionnaires after you have eaten.

#### **What are the risks?**

There is minimal risk in the study. However, allergies and reactions to food could occur. Thus, if you know of any allergies or intolerances to food types, please inform the researcher now. You may also experience a heightened awareness of your own eating behaviours, which could be distressing for some people. You will be given contact details for appropriate sources of support following testing, should this be required.

#### **What are the benefits?**

You will gain RPS credits for taking part in this study and the information will contribute to wider psychological knowledge.

#### **What if I do not wish to continue at any stage?**

You are free to withdraw from the study at any time. You can refuse to answer any question, and may refuse to do anything requested of you. In this case, your information and any results found will not be used.

**What happens to the information?**

All information is completely confidential. All information will be identified by code number, and will be seen only by the researchers. The consent forms will be kept separate from the questionnaires in order to maintain complete anonymity.

**What else can I expect from the researcher?**

You can ask any questions about the study that occur to you during your participation and request a copy of any of the results. You can opt to receive some information via email about the study after the data collection stage.

If you have any further questions after participating in this study you can email

[REDACTED]

[REDACTED]

## **Appendix 2: Participant consent form**

I have read the participant information sheet and any questions that I have about the study have been answered. I understand that I can ask further questions anytime during the participation of this study and I am free to withdraw at any time.

I understand that I can decline to eat any of the foods or answer any questions in the study if I wish and my results will not be used.

I agree to take part with the understanding that any data collected is completely confidential. I understand that the information will be stored in manual and electronic files but is subject to the provisions of the Data Protection Act.

**I confirm that I wish to participate in this study under the conditions set out here and in the Information Sheet.**

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Researcher: \_\_\_\_\_

### **Appendix 3: Participant sources of support information**

Please be aware that the questionnaires we have used today cannot be used as diagnostic tools. However, if participating in this study has raised some difficulties for you around eating, please use the following sources for further support and advice.

#### **Birmingham & Solihull Eating Disorders Service**

0121 301 2440

##### **Beat**

[www.b-eat.co.uk](http://www.b-eat.co.uk)

- helpline 0845 634 1414
- youth helpline 0845 634 7650
- email helpline [help@b-eat.co.uk](mailto:help@b-eat.co.uk)
- youth email helpline [fyp@b-eat.co.uk](mailto:fyp@b-eat.co.uk)

#### **Eating Disorders Support**

[www.eatingdisorderssupport.co.uk](http://www.eatingdisorderssupport.co.uk)

- helpline 01494 793 223
- email helpline [support@eatingdisorderssupport.co.uk](mailto:support@eatingdisorderssupport.co.uk)

#### **National Centre for Eating Disorders**

[www.eating-disorders.co.uk](http://www.eating-disorders.co.uk)

0845 838 2040

#### **Anorexia & Bulimia Care**

[www.anorexiabulimiare.org.uk](http://www.anorexiabulimiare.org.uk)

01934 710 679

#### **British Association of Behavioural and Cognitive Psychotherapies**

[www.babcp.com](http://www.babcp.com)

0161 705 4304

[babcp@babcp.com](mailto:babcp@babcp.com)

#### **Birmingham eating disorders self-help group**

0121 434 4343

#### **NHS Choices**

[www.nhs.uk](http://www.nhs.uk)

#### Appendix 4: Measures used

##### *Mood Scale (I) – pre-lunch measure*

Please answer all questions.

How HUNGRY do you feel right now?

NOT AT ALL		EXTREMELY
hungry		hungry

How FULL do you feel right now?

NOT AT ALL		EXTREMELY
full		full

How strong is your DESIRE to eat right now?

NOT AT ALL		EXTREMELY
strong		strong

How BLOATED do you feel right now?

NOT AT ALL		EXTREMELY
bloated		bloated

How HAPPY do you feel right now?

NOT AT ALL		EXTREMELY
happy		happy

How SAD do you feel right now?

NOT AT ALL		EXTREMELY
sad		sad

How STRESSED do you feel right now?

NOT AT ALL  
stressed

EXTREMELY  
stressed

How RELAXED do you feel right now?

NOT AT ALL  
relaxed

EXTREMELY  
relaxed

How IRRITABLE do you feel right now?

NOT AT ALL  
irritable

EXTREMELY  
irritable

How NERVOUS do you feel right now?

NOT AT ALL  
nervous

EXTREMELY  
nervous

How EXCITED do you feel right now?

NOT AT ALL  
excited

EXTREMELY  
excited

How TIRED do you feel right now?

NOT AT ALL  
tired

EXTREMELY  
tired

**Thank you**



***Mood Scale (II) – post-lunch measure***

Please answer all questions.

How HUNGRY do you feel right now?

NOT AT ALL		EXTREMELY
hungry		hungry

How FULL do you feel right now?

NOT AT ALL		EXTREMELY
full		full

How strong is your DESIRE to eat right now?

NOT AT ALL		EXTREMELY
strong		strong

How BLOATED do you feel right now?

NOT AT ALL		EXTREMELY
bloated		bloated

How HAPPY do you feel right now?

NOT AT ALL		EXTREMELY
happy		happy

How SAD do you feel right now?

NOT AT ALL		EXTREMELY
sad		sad

How STRESSED do you feel right now?

NOT AT ALL		EXTREMELY
stressed		stressed

How RELAXED do you feel right now?

NOT AT ALL  
relaxed

EXTREMELY  
relaxed

How IRRITABLE do you feel right now?

NOT AT ALL  
irritable

EXTREMELY  
irritable

How NERVOUS do you feel right now?

NOT AT ALL  
nervous

EXTREMELY  
nervous

How EXCITED do you feel right now?

NOT AT ALL  
excited

EXTREMELY  
excited

How TIRED do you feel right now?

NOT AT ALL  
tired

EXTREMELY  
tired

How vivid do you think your MEMORY of your lunch is?

NOT AT ALL  
vivid

EXTREMELY  
vivid

Finally, as a percentage, how much of the lunch offered to you do you think you ate?

\_\_\_\_\_ %

**Thank you**

### ***Game Questionnaire***

Thinking about the helicopter game you played, please answer all of the following questions:

How COMPLEX did you find the game?

NOT AT ALL		EXTREMELY
complex		complex

How INTERESTING did you find the game?

NOT AT ALL		EXTREMELY
interesting		interesting

How DIFFICULT did you find the game?

NOT AT ALL		EXTREMELY
difficult		difficult

How STRESSFUL did you find the game?

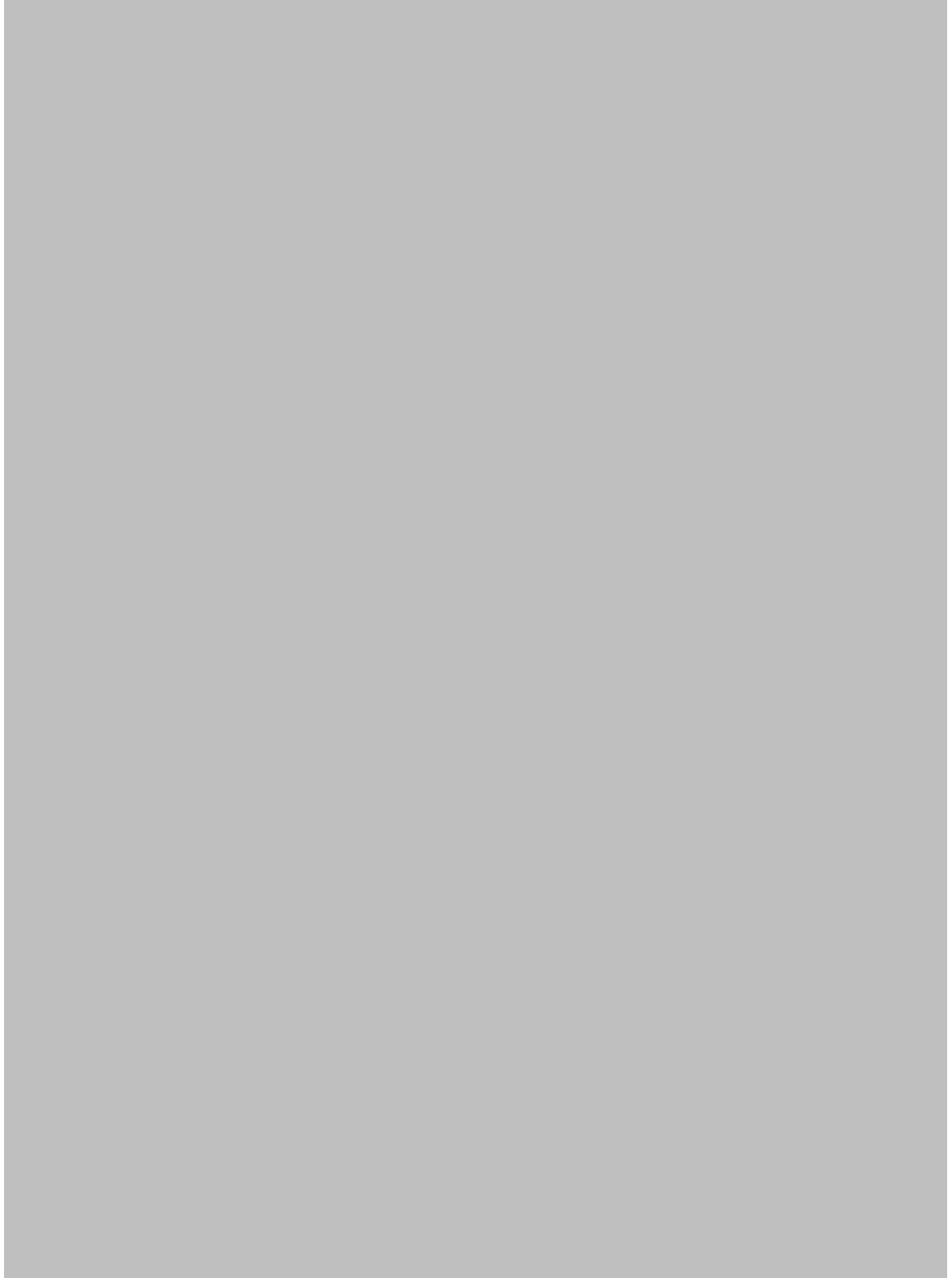
NOT AT ALL		EXTREMELY
stressful		stressful

**Thank you**

***Hospital Anxiety & Depression Scale (Zigmond & Snaith, 1983)***

**Tick the box beside the reply that is closest to how you have been feeling in the past week.**

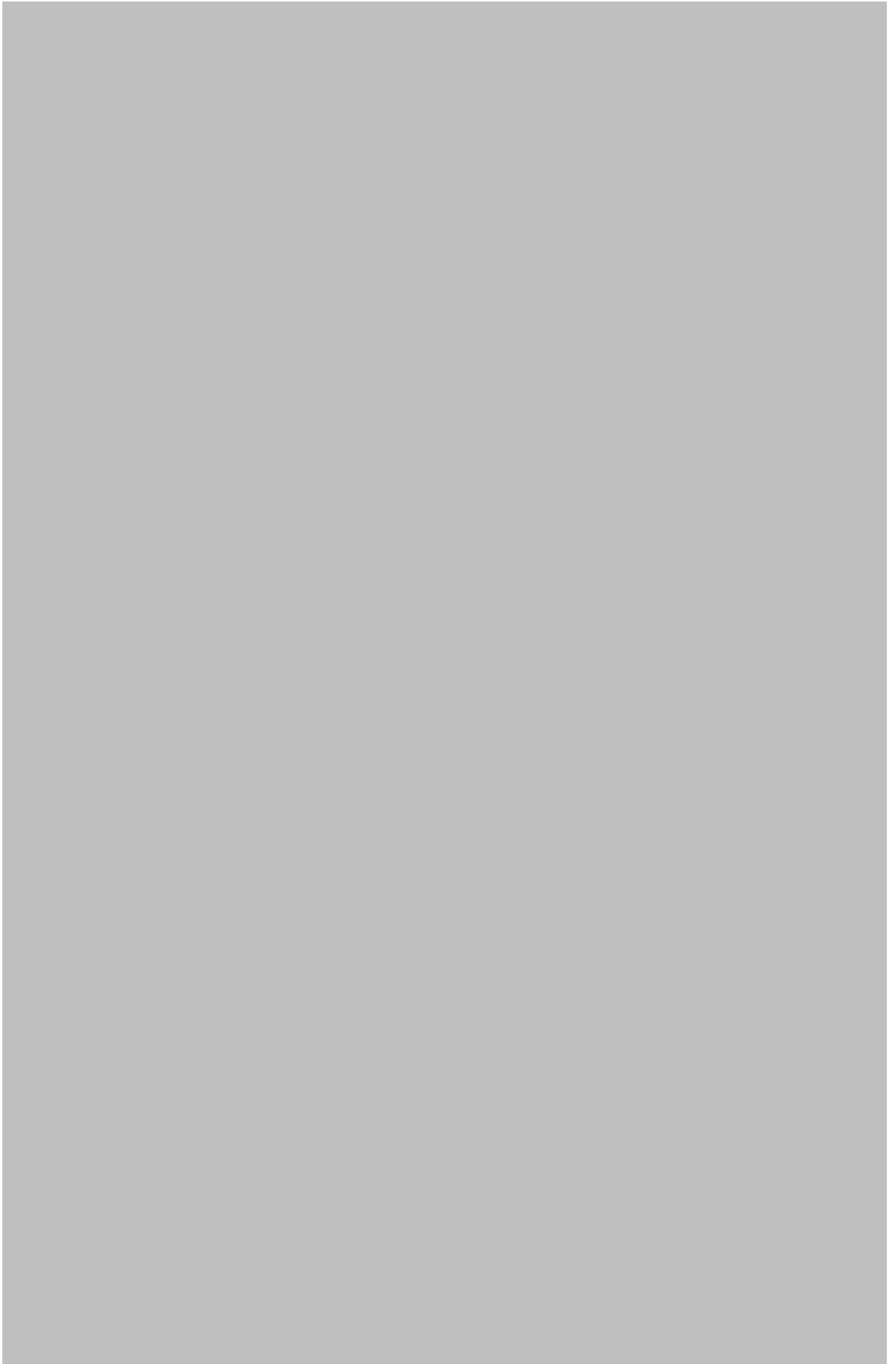
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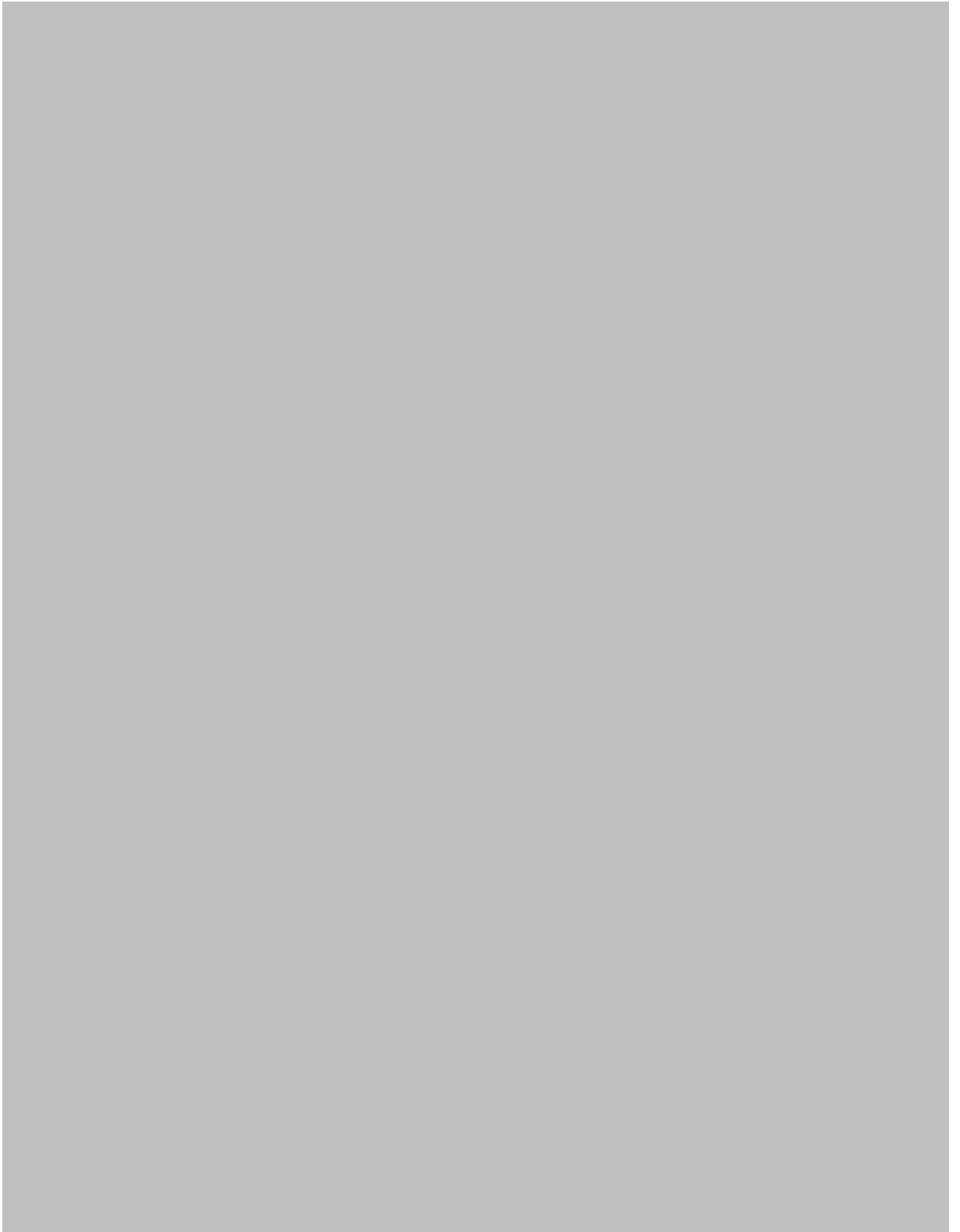


### **Three-Factor Eating Questionnaire (Stunkard & Messick, 1985)**

**Part 1: Please circle either 'true' or 'false' for each question.**









## Appendix 5: Additional data

Table A.1

		TFEQ Restraint	TFEQ Disinhibition	EDI-3 Drive for Thinness	EDI-3 Body Dissatisfaction	EDI-3 Bulimia
TFEQ Restraint	Pearson Correlation	1	.201	.643**	.312*	.092
	Sig. (2-tailed)		.124	.000	.015	.486
	N	60	60	60	60	60
TFEQ Disinhibition	Pearson Correlation	.201	1	.412**	.463**	.702**
	Sig. (2-tailed)	.124		.001	.000	.000
	N	60	60	60	60	60
EDI-3 Drive for Thinness	Pearson Correlation	.643**	.412**	1	.679**	.463**
	Sig. (2-tailed)	.000	.001		.000	.000
	N	60	60	60	60	60
EDI-3 Body Dissatisfaction	Pearson Correlation	.312*	.463**	.679**	1	.527**
	Sig. (2-tailed)	.015	.000	.000		.000
	N	60	60	60	60	60
EDI-3 Bulimia	Pearson Correlation	.092	.702**	.463**	.527**	1
	Sig. (2-tailed)	.486	.000	.000	.000	
	N	60	60	60	60	60

Sig. = significance level

\*\*  $p < .01$

\*.  $p < .05$

Eating Psychopathology Correlations

Table A.2

		Self-rated vividness score	Accuracy of memory
Self-rated vividness score	Pearson Correlation	1	-.277
	Sig. (2-tailed)		.032
	N	60	60
Accuracy of memory	Pearson Correlation	-.277	1
	Sig. (2-tailed)	.032	
	N	60	60

Sig. = significance level

\*  $p < .05$ 

## Memory Measure Correlations

Table A.3

		Cognitive loading score	HADS Anxiety Score	HADS Depression Score	Accuracy of memory	TFEQ Restraint Score	TFEQ Disinhibition Score	EDI-3 Drive for Thinness Score	EDI-3 Body Dissatisfaction Score	EDI-3 Bulimia Score
Cognitive loading score	Pearson Correlation	1	.209	.352	.023	-.405*	.077	-.325	.033	.158
	Sig. (2-tailed)		.259	.052	.901	.024	.681	.074	.861	.396
	N	31	31	31	31	31	31	31	31	31

Sig. = significance level

\*  $p < .05$ 

## Post Hoc Game Correlations